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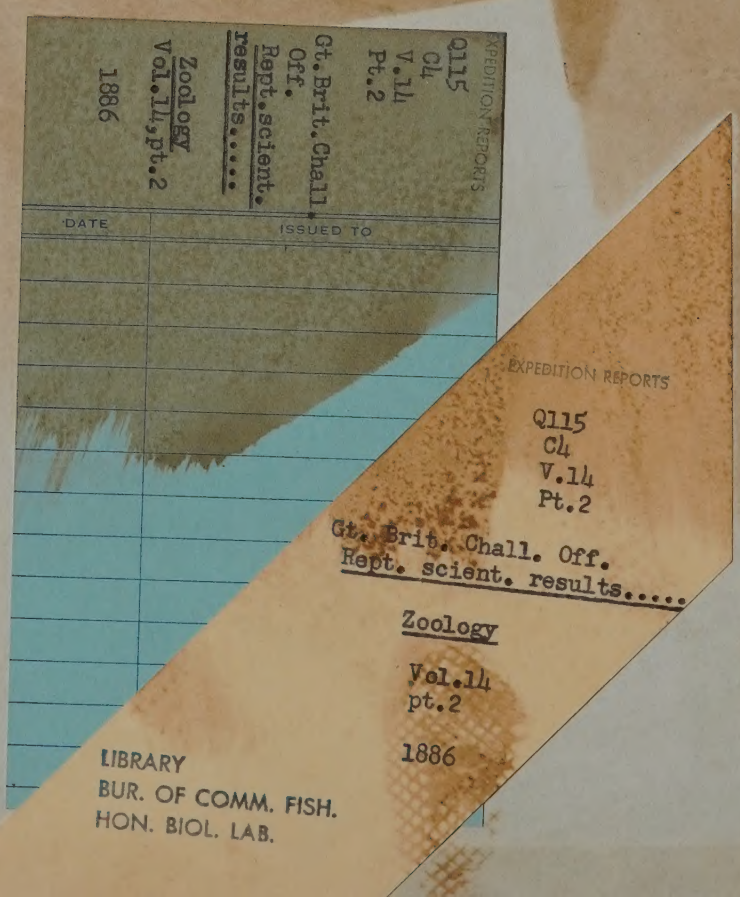

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REPORT

ON THE

SCIENTIFIC RESULTS

OF THE

VOYAGE OF H.M.S. CHALLENGER

DURING THE YEARS 1873-76

UNDER THE COMMAND OF

CAPTAIN GEORGE S. NARES, R.N., F.R.S.

AND THE LATE

CAPTAIN FRANK TOURLE THOMSON, R.N.

PREPARED UNDER THE SUPERINTENDENCE OF

THE LATE

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DIRECTOR OF THE CIVILIAN SCIENTIFIC STAFF ON BOARD

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ZOOLOGY—VOL. XIV.

PART XXXIX.—REPORT ON THE HOLOTHURIOIDEA.

By HJALMAR THÉEL.

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EDITORIAL NOTE.

This Memoir forms the Second and concluding Part of Dr. Hjalmar Théel's Report on the Holothurioidea of the Expedition. The First Part was published in 1882 in Volume IV., forming Part XIII. of the Zoological Series of Reports.

The Synopsis will be of great and permanent value to all working Naturalists, and Dr. Théel is to be congratulated upon the conclusion of this extensive, thorough and painstaking contribution to science.

John Murray.

Challenger Office, 32 Queen Street,
Edinburgh, *8th May* 1886.

ERRATA.

Page 41. The species described as *Botrylloides purpureum* was afterwards changed to *Botrylloides tyreum* (see p. 381).

Page 238, line 14 from top of page, *for* "*Psammaplidium incrustans*" *read* "*Psammaplidium effrenatum.*"

Page 267, line 3 from foot of page, *for* "*Diplosomoides*" *read* "*Didemnoides.*"

Page 276, lines 7 and 10 from top of page, *for* "Leptoclinidæ" *read* "Didemnidæ."

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7.
TRACK OF
H.M.S. CHALLENGER
Dec.r 1872 to May 1876
Red circles indicate the Station at which Tunicata Ophiuridæ Asteroidea and Antedon Comatulæ were collected.

THE

VOYAGE OF H.M.S. CHALLENGER.

ZOOLOGY.

REPORT on the HOLOTHURIOIDEA dredged by H.M.S. Challenger during the Years 1873-76. By HJALMAR THÉEL. Part II.

INTRODUCTION.

IN this second part of my work on the HOLOTHURIOIDEA I have not limited my labours to a description of those forms of the Apoda and Pedata which were brought home by the Challenger Expedition, but have added a short exposition of all shallow-water forms hitherto known. It was considered that such a monograph was highly desirable. It should not be forgotten, however, that the difficulties of a monograph are very great, especially in the case of the Holothurioidea, and that larger and smaller gaps must necessarily occur because of the frequent imperfection in the descriptions of many authors. Besides the Challenger collections, I have had at my disposition for comparison the very rich collection of the State Zoological Museum in Stockholm, kindly placed in my hands by Professor S. Lovén, a pretty large collection of tropical forms belonging to the Godeffroy Museum, and divers forms, partly types, from the Mediterranean and Mauritius, for the use of which I feel extremely obliged to Dr. E. von Marenzeller and Professor Karl Möbius.

The examination of the vast harvest brought home by the Challenger Expedition from different regions of the world, from the shore as well as from the abysses of the ocean, shows clearly that those Holothurids which live in the deep sea have two different derivations. The great majority are Elasipoda, which cannot be derived from the present shallow-water fauna, but must have originated from a past type that certainly bore another stamp. On the other hand, so far as can be judged from the results of the

expeditions hitherto made, the remaining Holothurids met with in the great depths are comparatively few both in species and individuals, and unmistakably show the closest relation to the present shallow-water fauna; so that while the Elasipoda have retired towards the abysses an infinitely long time ago, the latter have emigrated only at a comparatively much later period. The *Cucumariæ* and several other present shallow-water forms that have descended as far down as 2000 fathoms are veritable *Cucumariæ*, &c., that, in spite of their highly altered mode of life, have not yet had time to acquire any noteworthy deviations from the typical character of the genera in question. Such an emigration, which can be traced in the case of divers groups of marine animals, can only be effected extremely slowly, and undoubtedly takes place from competition with the shore fauna. We may suppose that the livelier struggle for existence which must arise in the littoral region or its vicinity, where an infinite number of various forms fight for subsistence, compels such forms, as lack sufficient power of resistance, to this so-called migration, and to retire to somewhat deeper and more peaceful regions, partly in their fully-developed state, partly in their later and more "conscious" embryonic stages, when, being independent of current and wind, they begin to crawl about. The others, from being unable to seek these places of refuge, succumb in that "Bellum omnium inter omnes" which is going on especially at or near the shore. But in proportion as the remaining shore fauna increases and extends downwards, even these formerly peaceful places become the field of a livelier competition in every respect, thereby necessitating a continual migration towards the greater depths.

The faculty hereby gained by the animals of enduring an ever-increasing depth, and of accommodating themselves to its conditions, being transmitted by inheritance and accumulated from generation to generation, must become a matter of great importance. If we take, for instance, two such forms as are with certainty known to belong to the same species, the one living at a great depth, let us say 1000 to 2000 fathoms, the other, on the contrary, belonging to shallow water, *e.g.*, *Brissopsis*, it appears to me impossible that the larvæ of the form accustomed to live near the shore should be able to attain their full development and to settle in the great depth; nor is the contrary case any more imaginable. The faculty of thriving and existing under such extremely peculiar conditions as are offered by the deep sea cannot be acquired at once. Indeed, we see every day examples of animals obliged to change climate and to alter their mode of life; the parents sustain the new conditions only with difficulty, or even perish by their influence, but their immediate progeny possesses greater power of resistance, and their later descendants do so to yet a higher degree, until the animal becomes finally acclimatised. The larva of a marine invertebrate or the full-grown animal itself, accustomed to live at a pretty moderate depth, for instance 50 to 100 fathoms, can only with difficulty, and during a short time, endure to live in an aquarium, however con-

veniently this may be fitted out; the differences in temperature, pressure, saltness, &c., are too great and the change too abrupt. Thus I think that a slow continuous emigration seawards is going on in the manner above sketched out, and there seems to be scarcely any doubt that the present deep-sea fauna will be changed in character in the course of time, chiefly on account of an emigration from the shore.

It is rather peculiar that such an emigration is not always necessarily accompanied with any very obvious alterations of the organisation of the animals. Striking examples of this fact are afforded, for instance, by those *Cucumariæ* which are met with in the depths. Nevertheless it must be admitted that, as a rule, judging at least from the Holothurioidea, alterations of a more or less essential nature are produced during the migration. But, on the other hand, there are strong grounds for supposing that most forms which have once surmounted the difficulties of the migration, and reached a more considerable depth, are in several respects endowed with the faculty of preserving "certain" of the characteristics of their ancestors, *i.e.*, the original shallow-water forms, longer than those descendants of the same ancestors which, from being able to maintain the struggle for existence with greater advantage, have remained in the littoral region. Indeed, natural selection ought to have played a far more important rôle in the latter region than in the monotony of the abysses, and to have in general called forth swifter and more perceptible changes. It is within the shore region that the Synaptidæ occur, which are of all Holothurids the most thoroughly modified and least Echinoderm-like in shape. Even the Molpadidæ, which are, in my opinion, somewhat older than the Synaptidæ, are extremely altered forms, although, like certain *Cucumariæ*, they have emigrated at a later period, and seem now to thrive principally at considerable depths.

Supposing that there is some truth in the hypothesis, which I shall attempt to prove below, that the common progenitors of all the Holothurioidea were not apodous *Synapta*-shaped animals, as has been hitherto asserted, but of the form of *Cucumariæ*, and provided with an open stone-canal, feet along the ambulacra, and a well-developed water-vascular system somewhat like that of the Echinids, it might appear strange that even among the present shallow-water forms there are to be found species which have in some respects maintained themselves almost like the primitive form. On the other hand, it ought not to be forgotten that, notwithstanding this similarity, these very forms have undergone great and sweeping changes. They have lost the communication of the stone-canal with the exterior, the calcareous ring is highly altered, the tentacles, which must originally have been simple and foot-like, have been transformed into very complicated dendroid organs, &c. And if we review the whole family of Dendrochirotæ more closely, they are found to have varied in every possible direction so as to adapt themselves to the various modes of life that necessarily follow from the infinitely varying conditions of the littoral region. The Dendrochirotæ have been split up, so to

speak, into a great number of types, diverging in widely different directions; compare the genera *Psolus*, *Colochirus*, *Cucumaria*, *Thyonidium*, &c.

But even the Elasipoda, which, from their number and often monstrous shapes, form such a characteristic feature of animal life in the bottom of the ocean, have suffered great alterations from the primitive type. Nevertheless they have still preserved much more of their important characteristics than any other Holothurid, and, if compared with one another, betray an evident tendency to uniformity in development, resulting no doubt from the monotony of the depths. It is probable that the Elasipoda have gained these modifications in the course of their migration towards deep water, and that a comparative repose has ensued in their evolution, after their having become acclimatised to the depths. However, life at the bottom of the ocean does not by any means permit of a stationary condition. The very fact of the Elasipoda occurring there in enormous masses clearly proves that fighting and development have gone on and are going on hand in hand there.

In the preceding remarks I have several times stated the opinion that the common ancestors of the Holothurioidea must have been *Cucumaria*-shaped animals furnished with an open stone-canal, feet, and a well-developed ambulacral system. This hypothesis, which can only be supported with a greater or less degree of probability, is contrary to the pedigrees proposed by my predecessors, in which the apodous Synaptidæ have been regarded as the oldest and least changed forms. Semper says, in his excellent work on the Holothurioidea of the Philippines :—"The apodous Holothurids are phylogenetically older than the pedate; the primitive form of the Holothurids cannot have been a pedate animal." In his opinion, these conclusions are justified by the fact that the water-vascular ring is the earliest persistent organ of the Holothurids, from which the other parts of the water-vascular system are afterwards developed. It seems to me that Semper has overlooked, as so many other inventors of pedigrees have done, the possibility of a reduction of organs taking place. However, the reduction and disappearance of organs is a fact that is quite as well established as the development of new ones; and in this particular case it appears much more probable that a reduction has taken place.

Without entering too far into details, I shall briefly state the reasons why I think it more probable that the pedate Holothurids are more primitive than the apodous. The Echinids, Asterids, and Holothurids have branched off from the same primitive type; on that point there is no doubt among the different authors. It is further well known that on examining the organisation of these classes somewhat more closely, we find—(1) that the water-vascular system, which is of extraordinary importance to and the most prominent characteristic of the Echinoderms, is entirely built on the same plan, inasmuch as it consists of a vascular ring, one or more stone-canals and Polian vesicles, and (excepting in the Apoda among the Holothurioidea) five radial ambulacral vessels giving out branches that pass internally into the ampullæ, externally into the feet, the latter

ending typically in a suctorial disk; (2) that the nervous system, which is scarcely less characteristic of the Echinoderms, is devoid of ganglia, and consists of a ring round the mouth with stems issuing from the ring and entirely following the water-vascular system. On account of these important coincidences, it appears to me that the common progenitor of the three classes ought to have had the above-mentioned organs already developed.

For it should not be assumed, I think, except from particularly cogent reasons, that these organs could have been developed so as to agree in every detail, after the three classes have diverged from one another. Accordingly, although in the apodous Holothurids the five radial ambulacral vessels are either totally wanting (in the Synaptidæ and some Molpadidæ), or, if existing, are without any connection whatever with the feet (in the rest of the Molpadidæ), it seems to me much more probable that this organisation of the Apoda is to be regarded as the result of a reduction than as an original condition. If a *Synapta*-shaped animal should be regarded as the common progenitor, the present apodous Holothurids must of course be considered to be its least altered descendants. Then we have to choose between two possibilities. There may have issued from this main stem a form that by developing ambulacral canals with feet and ampullæ has become the progenitor of the pedate Holothurids, the Echinids and the Asterids. In this case we arrive at the conclusion that the pedate Holothurids are more nearly related to the Echinids and Asterids than to the Apoda. The other possibility is that the pedate Holothurids on the one hand, and the Echinids and Asterids on the other, have branched off from the common main axis of the Echinoderms, and, independently of each other, developed feet and radial ambulacral vessels similar in detail. Although in this latter case the relationship between the Pedata and Apoda becomes more evident, still there remains the above-mentioned difficulty of understanding how such a complicated water-vascular system so similar in detail could have arisen, notwithstanding that the classes had developed independently of each other. On this account I think it more probable that the primitive form of the Holothurioidea has been a pedate animal, that the Synaptidæ represent their most differentiated form, and that in the Molpadidæ the reduction of the water-vascular system is still going on.

If, on the other hand, the derivation of the Holothurioidea is to be founded on Ontogeny, it would follow that the Elasipoda might justly claim to be regarded as being phylogenetically the oldest, because they have for the most part maintained the connection of the stone-canal with the exterior, and present such numerous instances of an extremely peculiar calcareous ring composed of spicules, and strongly reminding one of that of the larvæ, and because they have, moreover, in general, very primitive deposits in the perisoma, and have thus preserved many important peculiarities no doubt belonging to the common ancestors, but lost by the other Holothurioidea. The Elasipoda have, indeed, become much changed in other respects from the primitive type, as is

shown in my former work, but still it is clear, from the peculiar direction in which they have in general developed, that they cannot, since a very remote period, have had any connection with the other Holothurids, at least not with the Apoda, Rhopalodinidæ, and Dendrochirotæ. It is possible that the case is different with regard to the Aspidochirotæ. In this family the genus *Stichopus*, but above all the new genus *Pœlopatides*, brought home by the Challenger Expedition, presents in its whole organisation such a bewildering resemblance to some Elasipoda belonging to the family Psychropotidæ, that it is almost impossible to find any other difference than the presence or absence of respiratory trees. Thus it does not seem improbable, though it cannot by any means be taken for granted, that the Aspidochirotæ and the Elasipoda have sprung from a common branch, and have afterwards diverged from each other, the former losing the connection of the stone-canal with the exterior, &c., the latter losing the water-lungs, which must then be supposed to have existed in their common progenitor.

Bathymetrical Distribution.

With regard to the bathymetrical distribution of Apoda and Pedata, our present knowledge does not enable us to speak of any results of very general value. However, the Challenger Expedition has been successful even in these respects, several important discoveries having been made, proving that the present shallow-water fauna has far more outposts in the great depths of the ocean than at first supposed. Before the Challenger Expedition set out, only a very few forms belonging to the Apoda and Pedata were known from depths exceeding 100 fathoms, and scarcely one below 200 fathoms. The following list presents a view of the species met with in the deep sea at depths from 500 fathoms and under (see p. 8).

This list induces me to believe the following remarks to be true, or, at least, to have some probability.

1. Descendants of the recent shallow-water Holothurioidea have escaped to the greatest depths at which any living Holothurid has been obtained, viz., 2900 fathoms, but they are by no means so prevalent as the Elasipoda, nor do they form such a characteristic feature in the abyssal fauna.

2. Most of the forms met with in the deep sea below 500 fathoms are distinct from the shallow-water species, though they belong to the same genera.

3. Several species have a vast bathymetrical distribution, some individuals of them still living near the shore, others having descended without any obvious change in their organisation into the considerable depth of 500 to 700 fathoms, or, exceptionally, even deeper.

4. A wider distribution seawards of a species seems to take place preferably in the northern and southern oceans, where the different belts proceeding from the vicinity of

land outwards would seem to have in general a greater uniformity in temperature and other physical conditions than in the tropical and subtropical regions, where it is stated that the belts below 100 or 200 fathoms have lost the influence of the climate, &c., and present conditions far different from those above them. Such forms are *Myriotrochus rinkii*, from shore to 500 fathoms; *Echinocucumis typica*, from about 40 to 530 fathoms; *Thyone raphanus*, from 20 to 530 fathoms; *Holothuria intestinalis*, from 10 to 650 fathoms; *Holothuria tremula*, from 20 to 672 fathoms; *Trochostoma violacea*, from 20 to 700 fathoms; *Thyonidium pellucidum*, from about 30 to 1081 fathoms, &c. The two deep-sea species of *Synapta* are scarcely distinguishable from some of the shallow-water species.

5. *Pælopatides*, *Pseudostichopus*, *Acanthotrochus*, and probably even *Ankyroderma* are the only true deep-sea genera of Apoda and Pedata, no representatives of them having hitherto been obtained near the shore or, at least, from any trifling depth. Species of these genera very seldom seem to thrive at a less depth than 500 fathoms.

6. Among the Apoda the Synaptidæ are, with a very few exceptions, shore forms, living near the surface of the sea, while the Molpadidæ are probably in a state of emigration seawards, a great number of them having already reached the abysses and settled there.

7. The Dendrochirotæ and Aspidochirotæ are still true shore or shallow-water forms, though there are even here many exceptions, proving that their representatives are thriving even at great depths.

Concerning the geographical distribution, I refer the reader to the Geographical Tables, accompanied by some general remarks, at the end of this Report.

Table showing the Bathymetrical Distribution of the Holothurioidea.

	Locality.	Depth in fathoms.
Myriotrochus rinkii, Steenstrup.	Skager Rack south of Arendal, North Atlantic Ocean and Arctic Sea.	shore to 500
Echinocucumis typica, Sars.	North Atlantic Ocean.	40 to 530
Thyone raphanus, Düb. and Kor.	North Atlantic Ocean and Mediterranean Sea.	20 to 530
Stichopus challengeri, n. sp.	Antarctic Ocean.	550
Pœlopatides appendiculatus, n. sp.	Off Japan.	560
Stichopus tizardi, Théel.	Færöe Channel.	530 to 570
Trochostoma thomsonii, Dan. and Kor.	North Atlantic Ocean and Arctic Sea.	136 to 658
Trochostoma (?).	South Atlantic Ocean.	40 to 600
Psolus murrayi, n. sp.	South Atlantic Ocean.	600
Psolus operculatus, Pourtalès.	North and South Atlantic Oceans.	120 to 600
Psolus antarcticus, Philippi.	Antarctic Ocean and South Atlantic Ocean.	20 to 600
Holothuria intestinalis, Ascan and Rathke.	North Atlantic Ocean.	10 to 650
Holothuria tremula, Gunner.	North Atlantic Ocean.	20 to 672
Ankyroderma marenzelleri, n. sp.	Off New Zealand.	700
Trochostoma albicans, var. *glabra*, n. sp.	Off New Zealand.	700
Pœlopatides aspera, n. sp.	Off Philippine Islands.	700
Trochostoma violacea, Studer.	Kerguelen and off New Zealand.	20 to 700
Holothuria lactea, n. sp.	Atlantic Ocean and off New Zealand.	700 to 1000
Thyonidium pellucidum, Flemming.	North Atlantic Ocean.	30 to 1081
Holothuria murrayi (var.?).	North Atlantic Ocean.	1090
Acanthotrochus mirabilis, Dan. and Kor.	Between Norway and Spitzbergen.	658 to 1110
Trochostoma albicans, n. sp.	South-east of New York.	1240
Stichopus torvus, n. sp.	South Pacific Ocean.	1375
Holothuria murrayi, n. sp.	South Pacific Ocean.	1375
Cucumaria abyssorum, var. *hyalina*, n. sp.	Antarctic Ocean and South Pacific Ocean.	1375 to 1600
Cucumaria abyssorum, n. sp.	Antarctic Ocean.	1600 to 1975
Pseudostichopus villosus, var. *violaceus*, n. sp.	Antarctic Ocean.	1975
Trochostoma, sp. ?	West of Valparaiso.	2160
Pœlopatides confundens, n. sp.	South Pacific Ocean.	1375 to 2225
Cucumaria abyssorum, var. *grandis*, n. sp.	South Pacific Ocean.	1500 to 2225
Synapta abyssorum, n. sp.	Atlantic Ocean.	2350
Pseudostichopus villosus, n. sp.	Antarctic Ocean, Atlantic Ocean, and Pacific Ocean.	1375 to 2900
Holothuria thomsoni, n. sp.	North Pacific Ocean.	1875 to 2900

DESCRIPTION OF SPECIES.

Order I. APODA.

Body cylindrical or fusiform, devoid of pedicles and processes. Tentacles pinnate or digitate or peltate—digitate or simple unbranched.

Suborder I. APNEUMONA.

Respiratory-trees absent. Ciliated cups, attached to the mesentery, present. No radial ambulacral vessels.

Family SYNAPTIDÆ.

Genus *Synapta*, Eschscholtz, 1829.

Synapta beselii, Jæger, 1833 (Pl. I. fig. 12).

Habitat.—Zebu Reefs; several individuals. Amboina; several specimens. Reefs at Papiete; numerous individuals. Station 177, August 18, 1874; lat. 16° 45′ S., long. 168° 7′ E.; depths, 130 fathoms; a few specimens.

All the specimens dredged at the different localities above mentioned seem to agree most certainly with those described by Jæger, Müller, Semper, &c. However, no one has, so far as I know, noted anything with regard to the peculiarity, that the very numerous Polian vesicles are, as it were, branched, that is, that four or five of them arise from the same base, and that some of these always appear to be more or less rudimentary. This arrangement of the Polian vesicles is very conspicuous in the individuals from Zebu Reefs. Amongst the specimens brought home from the reefs at Papiete there are several provided with two branched madreporic canals, of which, as is well known, the typical forms have but a single one.

Synapta glabra, Semper, 1868 (Pl. I. fig. 6).

Habitat.—Zebu Reefs; several mostly rather incomplete specimens.

I hesitated long whether to refer the animals in question to *Synapta glabra*, Semper, or to *Synapta grisea*, Semper, or *Synapta serpentina*, Müller, forms which are very nearly related to it. According to Semper, however, the fact that the branches of the tentacles are webbed together by a thin membrane characterises *Synapta glabra* and distinguishes it from the remaining forms. Some of the specimens brought home from Zebu Reefs also seem to be in possession of such a web between the branches or digits, which are rather short, while in other forms this web is almost inconspicuous. Mostly, the branches of the tentacles are highly contracted, whence it is difficult to discern their arrangement, a difficulty greater inasmuch as the animals themselves have undergone some changes by reason of their long immersion in spirits. The calcareous ring is more nearly allied to that of *Synapta glabra* than to those of the other species. The stock or handle of the anchor (Pl. I. fig. 6, *a*) is provided with six to eight small processes which are rough with minute spines, and that part of the anchor where the arms or flukes join each other carries as many as eight or more small teeth.

Colour in alcohol, dark brownish on the upper surface and lighter on the under. Length of the largest specimen about 500 mm.

Another individual, also obtained at the same Station, possibly forms another species, but unfortunately the calcareous matters have been dissolved by the impure alcohol, and the crown of tentacles is destroyed, so as to make closer investigations impossible.

Synapta lappa, Müller, 1850 (Pl. I. fig. 7).

Habitat.—Gomera, off Tenerife, February 10, 1873; depth, 70 fathoms; several fragments.

The highly macerated and fragmentary condition of the individuals I have had at my disposal prevents minute examination. To judge from what I have observed, they must belong to this species of Müller. The Polian vesicles, the single madreporic canal, the shape of the calcareous ring and of the deposits in the body-wall, &c., agree most strikingly with the description of Müller. The tentacles, however, fifteen in one individual and sixteen in another, do not seem to be of quite equal size. Besides, the anchors have, as a rule, anteriorly where the flukes join each other, as many as eight small teeth. The numerous miliary granules resemble those in *Synapta grisea*, Semper, and *Synapta glabra*, Semper.

Synapta picta, n. sp. (Pl. I. figs. 9, 10).

Tentacles twelve, each with about twenty-five digits; one ventral tentacle considerably smaller than the others. Calcareous deposits closely resembling those in

Synapta recta, Semper, and *Synapta indivisa*, Semper. Length of the anchors about 0·24 mm., and that of the plates about 0·17 mm. Vertex of the anchors (Pl. I. fig. 9, *a*) with a few small teeth. Polian vesicles of varying size; five larger, the largest about 6 mm. long, and some rudimentary ones. Madreporic canal single. Immediately behind and attached to the calcareous ring (Pl. I. fig. 10) a narrow firm ring of connective tissue, which, however, does not occupy the whole space between the former and the water-vascular ring, but leaves the greatest part of the tentacular canals free. Colour in alcohol, reddish-brown, with numerous white spots, which are derived from agglomerations of miliary granules. Length of the individual, 30 to 35 mm.

Habitat.—Bermuda; a single specimen.

Synapta distincta, von Marenzeller, 1881 (Pl. I. fig. 8).

Habitat.—Japan, 8 to 50 fathoms; some fragments. Station 233B, May 26, 1875; lat. 34° 18′ N., long. 133° 35′ E.; depth, 15 fathoms; blue mud; some fragments.

To judge from the calcareous deposits, the fragments in question must belong to an animal, identical with, or at least very nearly related to, the species of v. Marenzeller. Most of the anchors have a length of 0·23 mm., but there are some scattered ones to be seen, which measure about 0·4 mm. The anchor-arms are commonly provided with five to six serrations, but I have also observed flukes with only two or three. The plates differ (Pl. I. fig. 8, *a*) from those in the typical form figured by v. Marenzeller in possessing more holes; they vary in length from 0·18 mm. to 0·3 mm. In addition to the ×-shaped miliary granules, which sometimes become more or less deformed, so as to present the appearance of minute spinous bodies with one, two, or more holes, numerous rounded or oval granules are present, resembling those found in the muscular coats of the body-wall of *Synapta digitata*, &c. Even in *Synapta distincta* these granules belong to the muscular layers or to that part of the integument which borders on them; as a rule, they seem to be present in all the species of this group of *Synaptæ* examined by me. The body-wall is yellowish-white, more or less transparent. Length of the largest fragment, 95 to 100 mm.

One of the fragmentary specimens brought home from Station 233B has the plates almost without spines or processes, while the other has them furnished with minute elevations; the former is peculiar in having the ×-shaped miliary granules very numerous and closely crowded. The anterior portion of another individual, which differs to some extent from the typical forms, was also obtained from Japan, whence I hesitated long whether to refer it to the species in question or to form a new one for it. The species of v. Marenzeller seems generally to be in possession of calcareous plates of a more irregular shape, and furnished with larger though fewer holes and smaller spines, than is the case in this individual. Besides, the miliary granules of this latter specimen seem to

be slightly larger and more numerous, and they partly resemble those figured by v. Marenzeller, but mostly have a more complicated form (Pl. I. fig. 8, *b*). At first sight it may appear as if the difference presented by the miliary granules were of such importance as to justify a new species, but at the same time I have seen a great number of transitional forms, which evidently prove that the simple ×-shaped granules can pass over into the more complicated ones.

The individual in question has twelve tentacles, each with four slender digitations. The integument is of a whitish colour, inclining to yellowish, and is covered with numerous minute papillæ. The madreporic canal is single and dorsal as to its position. No cartilaginous ring behind the calcareous ring. Five ventral Polian vesicles about 15 mm. long are present. The form of the calcareous ring is best seen by reference to the plates.

There is no doubt that *Synapta distincta*, v. Marenzeller, is very nearly related to several previously known species, viz., *Synapta pseudo-digitata*, Semper, *Synapta innominata*, Ludwig, *Synapta molesta*, Semper, and *Synapta benedeni*, Ludwig. All the forms here enumerated seem to be very closely allied to one another. When comparing their calcareous deposits, &c., one cannot but think that their distinguishing characteristics are mostly very unimportant. Moreover, our present knowledge is too unsatisfactory to decide to what degree the deposits of the same species are capable of varying in form as well as in size.

Synapta verrilli, n. sp. (Pl. I. fig. 1).

Tentacles twelve, each with four slender digitations. Two larger ventral Polian vesicles, about 5 mm. long, and between these two smaller ones. Madreporic canal single. No cartilaginous ring. The calcareous ring (Pl. I. fig. 1, *c*) almost like that in *Synapta similis*, Semper, or *Synapta molesta*, Semper. The anchors (Pl. I. fig. 1, *a*) often more or less distinctly asymmetrical, and their flukes commonly provided with about five serrations; the posterior margin of the handle rough from minute serrations. Length of the anchors about 0·3 mm. The irregularly rounded plates (Pl. I. fig. 1, *b*) with the margin rather uneven and never completed; their holes are large, comparatively few in number, and provided with minute spines round the margin. The holes are smaller and more numerous in the articular end of the plates. Length of the plates about 0·27 mm., and their greatest breadth about 0·25 mm. The miliary granules (Pl. I. fig. 1, *d*) only in the form of oval or oblong bodies. Colour in alcohol, yellowish-white. Length of the largest individual about 23 mm.

Habitat.—Station 186, September 8, 1874; lat. 10° 30′ S., long. 142° 18′ E.; depth, 8 fathoms; coral mud; two specimens.

This species seems to bear the greatest resemblance to *Synapta innominata*, Ludwig,

from which it is distinguished only by the lack of any × -shaped miliary granules, and by the anchors which are of equal size.

Synapta insolens, n. sp. (Pl. I. fig. 3).

Tentacles twelve, each with four digitations. Polian vesicles five, two of which are comparatively small. Madreporic canal single. Cartilaginous ring absent. The anchors (Pl. I. fig. 3, *a*) about 0·64 mm. long, asymmetrical or of almost symmetrical form, with twelve to eighteen serrations on each fluke. The posterior margin of the handle rough, with minute serrations. The plates (Pl. I. fig. 3, *b*), about 0·56 mm. long, and of about the same breadth, are pierced by numerous circular holes, which diminish in size from the centre to the circumference; numerous small spines are visible round the margin of the holes. The margin of the anterior half of the plates is free from any roughness, and evenly rounded, almost semicircular, while the margin of the remaining narrower part of the plates is, so far as I know, never completed. Miliary granules (Pl. I. fig. 3, *c*) are present only as rounded or oval bodies. The surface of the transparent body-wall is rough from the anchors. Colour in alcohol, yellowish-white. Length about 110 mm.

Habitat.—Station 188, September 10, 1874; lat. 9° 59′ S., long. 139° 42′ E.; depth, 28 fathoms; green mud; a single individual.

Synapta insolens must be nearly related to *Synapta bankensis* of Ludwig, from which, however, it differs by the want of the small anchors and plates as well as by a considerably fewer number of holes in the plates, &c.

Synapta aculeata, n. sp. (Pl. I. fig. 2).

The integument is very rough from the comparatively large anchors. The anchors (Pl. I. fig. 2, *a*, *b*, *c*, *d*) vary greatly in shape; scarcely one exactly resembles another. Those with flukes at each end of the shank are very rare. The flukes always carry six to eight serrations. The handle bears on its posterior margin some spinous processes. Length of the anchors about 1·1 mm. The plates (Pl. I. fig. 2, *e*) are concave on their upper surface, so that the margin of their sides becomes directed upwards or rather outwards. The margin of the plates is never completed, but uneven with processes. The holes in the plates are comparatively small, and the anterior ones are commonly larger than those in the centre; their margin is smooth. Length of the plates about 0·74 mm. The miliary granules (Pl. I. fig. 2, *f*), of an oval form, seem exclusively to belong to the ambulacra, where they are disposed in double rows. Colour in alcohol, light brownish or dirty white. The surface of the integument with numerous small scattered papillæ of a dark reddish colour. Length of the fragment I have had at my disposal about 65 mm.

Habitat.—Station 232, May 12, 1875; lat. 35° 11′ N., long. 139° 28′ E.; depth, 345 fathoms; bottom temperature, 41·1; green mud; a middle part of an individual.

Synapta challengeri, n. sp. (Pl. I. fig. 4).

Tentacles twelve, each with four digitations, the two inferior of which are smaller. Two ventral Polian vesicles. Madreporic canal single, dorsal. Cartilaginous ring absent. The anchors (Pl. I. fig. 4, *a*) from 0·24 to 0·33 mm. long, with some minute serrations on the flukes. The plates (Pl. I. fig. 4, *b*), from 0·18 to 0·23 mm. long, are oblong, comparatively small, very irregular, and as it were undeveloped; their holes have the margin smooth. The miliary granules (Pl. I. fig. 4, *c*), of very variable shape, are commonly oblong, and evidently belong to the muscular layers or to that part of the integument which borders on them. Integument is yellowish-white, and covered with minute papillæ. Length of the very narrow individual about 80 mm.

Habitat.—Station 174, August 3, 1874; lat. 19° 6′ S., long. 178° 14′ 20″ E.; depth, 140 fathoms; coral mud; two specimens.

Synapta incerta, Ludwig, and *Synapta dubia*, Semper, are forms nearly related to the species in question, but they differ from it in the shape of their miliary granules as well as in their calcareous plates being provided with a handle.

Synapta incerta, Ludwig, 1875, var. *variabilis*, nov. (Pl. I. fig. 5).

Habitat.—Japan, 8 to 50 fathoms; some more or less fragmentary individuals.

The only differences of importance to note between the specimen examined by me and the typical form concern the plates and the miliary granules. The plates (Pl. I. fig. 5) in the specimen obtained at Japan are not quite so regularly constructed, and the miliary granules are absent or oval, and never obtain the characteristic bracket-like form figured by Ludwig. Length of the anchors, 0·13 to 0·18 mm. Length of the plates, 0·1 to 0·12 mm. The flukes of the anchors with two to four minute serrations, and sometimes smooth. The body is very narrow, cylindrical. Length of the fragment about 72 mm. Tentacles twelve, with four rather long digitations, and a short obtuse middle knob. A single Polian vesicle present. Colour whitish, transparent, inclining to violet. It seems most probable that *Synapta dubia*, *incerta*, and *variabilis* represent varieties of one and the same species.

Synapta abyssicola, n. sp. (?) (Pl. I. fig. 11).

The plates (Pl. I. fig. 11, *b*) are almost circular and concave on their upward directed surface; for the most part they closely resemble those in *Synapta distincta*, v.

Marenzeller, figured by me, but here and there plates are to be found which have the margin of the holes quite smooth. No miliary granules are visible. The anchors (Pl. I. fig. 11, *a*), generally broken off, have some serrations on the flukes, and their handle is provided with several processes. Length of the anchors about 0·54 mm. Length of the plates about 0·52 mm.

Habitat.—Station 346, April 6, 1876; lat. 2° 42′ S., long. 14° 41′ W.; depth, 2350 fathoms; bottom temperature, 34°·0; Globigerina ooze; a small fragment.

The discovery of this abyssal *Synapta* is of very great interest, proving that the representatives of this genus belong not to the shallow-water fauna only, and it is rather unexpected that no more striking differences exist between forms living under such various conditions. In fact, *Synapta abyssicola* bears the strongest resemblance to several shallow-water forms, and is distinguished by no marked peculiarity. The anchors have the form common to most of the Synaptidæ occurring in shallow water, and the plates have the characters of those of *Synapta distincta*, v. Marenzeller, as well as of *Synapta pseudo-digitata*, Semper.

Genus *Chirodota*, Eschscholtz, 1829.

Chirodota purpurea, Lesson, 1830 (Pl. II. fig. 1).

Tentacles twelve, of equal size, each with about ten digitations, increasing in length towards the end of the tentacles, so that the two terminal are much longer than the remaining ones. There are also tentacles with as many as thirteen digitations. The thin integument is covered with minute dark papillæ, and in some specimens the dorsal surface is provided with whitish tubercles containing wheels. Excepting series of minute, obtuse, unbranched rods (Pl. II. fig. 1, *b*) along the muscular bands, there are only very scattered aggregations of wheels present. Diameter of the wheels (Pl. II. fig. 1, *a*) from 0·14 mm. to 0·16 mm. Madreporic canal single. Polian vesicles of unequal size, and varying in number from eight to sixteen. Calcareous ring consisting of twelve pieces, the five radial pieces being perforated for the nerves. Colour in alcohol, darker or lighter purplish-red. Length about 65 mm. or more.

Habitat.—Station 316, February 3, 1876; lat. 51° 32′ S., long. 58° 6′ W. (Falkland Islands); depth, 4 to 5 fathoms; mud; numerous more or less macerated individuals.

It is remarkable that the forms dredged at the Falkland Islands are devoid of any sigmoid deposits, while those found by the Challenger Expedition in the Strait of Magellan and at Kerguelen Island have, as a rule, such deposits. Therefore it seems to me far more credible that *Holothuria purpurea* of Lesson, which was also obtained at Falkland Islands (Soledad), is identical with the above described forms rather than with

Studer's *Sigmodota purpurea*, which is found living in the Strait of Magellan and at Kerguelen Island.

Chirodota contorta, Ludwig, 1875 (Pl. II. fig. 2).

Habitat.—Marion Island, 50 to 75 fathoms; several individuals. Off Christmas Harbour, 120 fathoms; one individual. Balfour Bay, 20 to 60 fathoms; several specimens. Betsy Cove, 25 fathoms; one individual. Station 313, January 20, 1876; lat. 52° 20′ S., long. 67° 39′ W.; depth, 55 fathoms; bottom temperature, 47·8; sand; a few individuals. Station 314, January 21, 1876; lat. 51° 35′ S., long. 65° 39′ W.; depth, 70 fathoms; bottom temperature, 46·0; sand; numerous individuals.

The tentacles with ten to twelve digitations, the terminal of which are largest. The sigmoid deposits (Pl. II. fig. 2, *b*) exactly resemble those described by Studer in *Sigmodota purpurea*. They reach a length of about 0·28 mm., while the diameter of the wheels is only 0·12 mm. The specimens brought home from Station 314 differ from the others in having the aggregations of wheels much more crowded, while the aggregations of wheels (Pl. II. fig. 2, *a*), especially in the individuals obtained at Marion Island, are very scattered, so that they almost appear at first sight to be devoid of them. The specimens examined by me differ from Ludwig's type in their violet colour. It seems very peculiar that all the individuals dredged by the Challenger Expedition in several localities at the Kerguelen Islands, as well as in or in the neighbourhood of the Strait of Magellan, belong to Ludwig's *Chirodota contorta*. Not a single specimen of Studer's *Sigmodota purpurea* was obtained, therefore I cannot help thinking that the very scattered aggregations of wheels have escaped the attention of Studer, because of the sigmoid bodies being so conspicuous by their number as well as by their size.

Chirodota australiana, Stimpson, 1856.

Habitat.—Port William (New Zealand, Falkland Islands?); depth, 5 to 10 fathoms; two specimens.

The species is nearly related to *Chirodota contorta*, and differs from it mainly in possessing but ten tentacles, each with about eight digitations, and in having a single Polian vesicle. Length of the specimens, 35 mm. Colour in alcohol, light dirty brown. The wheels and sigmoid bodies seem to be present all over the body. Diameter of the wheels, 0·14 mm. Length of the sigmoid deposits about 0·14 mm. From the macerated state of the animals, the arrangement of the aggregations of wheels is not distinct. A single madreporic canal is present. The reproductive organs consist of two very long, slender, simple genital tubes. The Challenger specimens seem to agree in all respects with the species of Stimpson.

Chirodota japonica, v. Marenzeller, 1881 (Pl. II. fig. 3).

Habitat.—Port Jackson, 2 to 10 fathoms. Some highly incomplete specimens.

The cylindrical body is very elongated, up to 170 mm. long or more. The alimentary canal is distended by sand so as to fill up the whole peritoneal cavity. The ten tentacles are provided with fourteen to sixteen digitations of almost equal length. No traces of wheels seem to be present. The sigmoid deposits (Pl. II. fig. 3), resembling those in *Chirodota contorta*, Ludwig, have a length of about 0·14 mm., thus being slightly larger than those in the type of v. Marenzeller; they are collected in groups of three to nine. A single Polian vesicle is present. Colour in alcohol is whitish-grey or pale brownish-violet, and the integument is covered with numerous small dark red or violet papillæ.

The species strictly belongs to the genus *Sigmodota*, proposed by Studer for the reception of forms which are devoid of wheels and are characterised by the possession of sigmoid deposits within the integument. So far as is known, no other difference exists, distinguishing *Sigmodota* from *Chirodota*. Now it seems to me that the genus *Sigmodota* would be well founded if it could be proved that the sigmoid deposits were really characteristic of it. This seems, however, not to be the case. In fact, Ludwig's *Chirodota contorta*, besides wheels, possesses such deposits, formed exactly after the same plan as those in the genus *Sigmodota*; consequently, the species just mentioned combines the two extremes with each other, and v. Marenzeller is doubtless right when placing the genus of Studer under the list of synonyms.

Chirodota sp. ?

Habitat.—Station 192, September 26, 1874; lat. 5° 49′ 15″ S., long. 132° 14′ 15″ E.; depth, 140 fathoms; blue mud. Some fragmentary individuals, so incomplete as to make it impossible to determine their position. Only agglomerations of wheels seem to be present. Tentacles destroyed.

SURVEY OF THE GENERA AND SPECIES, HITHERTO KNOWN, REFERRED TO THE APNEUMONA.

Family I. Synaptidæ.

Tentacles digitate or pinnate. Body cylindrical. Deposits in the shape of anchors or wheels, seldom absent.

Genus 1. Rhabdomolgus, Keferstein, 1863.

Tentacles ten, elongate, undivided, slightly lobate on the sides. Deposits absent in the perisoma (?). Hermaphrodite (?).

Rhabdomolgus ruber, Keferstein, 1863.

Habitat.—St. Vaast (Keferstein).
This remarkable form is very doubtful, and needs to be re-examined.

Genus 2. Anapta, Semper, 1868.

Tentacles twelve, small, pinnate, each with eleven fine digits. Body covered with papillæ, devoid of other deposits than minute elongate or oval grains. Hermaphrodite.

Anapta gracilis, Semper, 1868.

Habitat.—Manila (Semper).

Genus 3. Synapta, Eschscholtz, 1829.

Tentacles ten to twenty-five, digitate or pinnate. Deposits—anchors, anchor-plates, and miliary granules. Hermaphrodite.

A. Tentacles pinnate, mostly with numerous, always with more than five digits. Anchor-plates roundish or oval, always (excepting in *Synapta beselii*) symmetrically formed with six to seven large dentate holes, and, besides, some smaller smooth ones at their narrower articular end, which forms a distinct bow. Circumference of the plates mostly smooth and complete.

I. Tentacles twenty-five.

Synapta kefersteinii, Selenka, 1867; Semper, 1868.

Tentacles with thirty to eighty digits. A broad cartilaginous ring present. Numerous Polian vesicles. A single madreporic canal. Anchor-arms smooth. Anchor-plates with six larger dentate holes, and three larger and some small smooth ones at the handle. Miliary granules—small irregular rods or incomplete rosettes.

Habitat.—Sandwich Islands (Sel.) and Navigators' Islands (Semp.).

Among the Holothurians preserved in the State Zoological Museum in Stockholm I have found the anterior portion of a *Synapta* obtained from Navigators' Islands. It has twenty tentacles, two or three of which are slightly smaller, each furnished with as many as twenty-five digits on each side. The calcareous deposits, the numerous Polian vesicles, the cartilaginous ring, the single madreporic canal, &c., completely agree with those of *Synapta kefersteinii*. On account of the number of tentacles, I at first believed the animal in question to be a specimen of *Synapta tenuis*, but on closer examination it became apparent that it presented in many respects the most obvious resemblance to *Synapta kefersteinii*. So far as is known for the present, the number of tentacles is the only difference existing between the two species just mentioned, but, as a matter of fact, several species of *Synapta* are capable of variation in this very respect. There seems to be but little doubt that *Synapta kefersteinii* and *Synapta tenuis* are identical forms.

II. Tentacles twenty or twenty-one.

Synapta tenuis (*Fistularia*), Quoy and Gaimard, 1833; Selenka, 1867.

Tentacles with fourteen to sixteen digits. Unsatisfactorily known.

Habitat.—New Ireland (Quoy and Gaimard).

III. Tentacles fifteen.

1. *Anchor-plates asymmetrical, elongate, subrectangular, nearly twice as long as broad, with numerous holes with smooth margins. Madreporic canal branched.*

Synapta beselii, Jæger, 1833; J. Müller, 1850 and 1854; Held, 1857; Semper, 1868. *Oncinolabes fuscescens*, Brandt, 1835 (according to Ludwig 1881). *Synapta astrolabi*, Held, 1857. *Synapta agassizii*, Selenka, 1867.

Tentacles with numerous digits. Cartilaginous ring with fifteen holes posteriorly.

Numerous Polian vesicles. Madreporic canal single, dorsal, branched. When living, the animal is characterised by five longitudinal double rows of numerous large, round protuberances. Anchor-arms smooth. Rosette-shaped miliary granules present.

Habitat.—Zanzibar (Selenka), Mauritius (Haacke, Ludwig), Indian Ocean (Ludwig), Celebes (Jæger), Society Islands (Selenka), Philippine Islands (Semper), Ualan in Caroline Islands (Brandt), Nicobar Islands (Semper).

(Mus. Holm.) Several specimens from Navigator Islands, Tahiti, Eimeo, Mauritius, and Goonong. One dredged at Tahiti seems to be Selenka's *Synapta agassizii*, distinct from the typical form by possessing five darker longitudinal bands.

2. *Anchor-plates symmetrical, with six to seven larger dentate holes. Madreporic canals simple.*

a. Cartilaginous ring present.

Synapta vittata (*Fistularia*), Forskaal, 1775; Jæger, 1833; Blainville, 1834; J. Müller, 1854; Held, 1857; Herapath, 1865; Ludwig, 1882. *Tiedemannia vittata*, Leuckart, 1830.

Body with a series of protuberances along the five broader whitish longitudinal bands (according to Forskaal). Cartilaginous ring present (according to Müller). Anchors with smooth arms, and anchor-plates with six larger dentate holes and three slightly smaller and some minute smooth holes (according to Ludwig). No fully satisfactory description is given.

Habitat.—Red Sea (Forskaal, Gray, Rüppel, &c.).

Synapta nigra, Semper, 1868.

Digits of the tentacles united by a web at their base. Numerous Polian vesicles. A single madreporic canal. Cartilaginous ring posteriorly with small holes. Anchor-arms smooth. Anchor-plates with six large dentate holes and three slightly smaller and some minute smooth holes. Miliary granules resembling incomplete rosettes.

Habitat.—Bohol (Semper).

b. Cartilaginous ring absent.

Madreporic canals numerous.

Synapta glabra, Semper, 1868; Ludwig, 1881. (?) *Oncinolabes mollis*, Brandt, 1835.

Digits of the tentacles united by a web as far as their middle. Body with round protuberances, like those in *Synapta beselii*. Numerous Polian vesicles. Anchor-arms smooth. Anchor-plates with seven large dentate holes and some small smooth ones at the handle; the seventh large hole is only partly dentate. Miliary granules—scattered rosettes.

Habitat.—Bohol (Semper), (?) Guahan in Marianne Islands (Brandt).

(Mus. Holm.) Two specimens from Fiji Islands, agreeing in all respects with those described by Semper. Colour uniformly reddish-brown or dark brown, which colour seems to characterise this species from the following three, which are marked with spots, bands, or shades of a darker colour on a lighter ground. So far as I can discover, the digits of the tentacles are united by a distinct web. Cartilaginous ring absent, but the tentacular canals are united by a web, excepting in the calcareous ring, where openings are left between them. Numerous small simple madreporic canals and Polian vesicles round the water-vascular ring.

Synapta grisea, Semper, 1868.

Digits of the tentacles free. Numerous Polian vesicles. Deposits like those in the preceding species, but the miliary granules are much more numerous and aggregated.

Habitat.—Bohol (Semper), Fitzroy Island and Queensland (Bell), Indian Ocean (Ludwig).

(Mus. Holm.) Two specimens dredged at Bowen, differing mainly from *Synapta glabra* in the colour, which, like that in *Synapta beselii*, is marked with spots, bands, and shades of a darker greenish-grey colour on a lighter dirty ground, and by possessing numerous rosette-shaped miliary granules collected in masses.

Synapta serpentina, J. Müller, 1850 and 1854; Semper, 1868. (?) *Synapta raynaldi*, Held, 1857. (?) *Synapta intestinalis*, Held, 1857.

This species seems to agree in all points with *Synapta grisea*, excepting with regard to the calcareous ring, which presents some small differences. They may probably be identical.

Habitat.—Celebes (Müller), Zanzibar (Selenka).

β. One or several madreporic canals.

Synapta lappa, J. Müller, 1850 and 1854.

Digits of the tentacles free. Numerous Polian vesicles. Anchor-arms smooth. Anchor-plates with seven large dentate holes, and two large and some minute smooth holes.

Habitat.—West Indies (Müller).

In 1850 Müller speaks of but a single madreporic canal, but in 1854 he says that one or several may be present. The miliary granules have probably been overlooked. The anchor-plates differ from those in the three preceding species in the presence of the two larger smooth holes at the handle.

γ. A single madreporic canal.

Synapta godeffroyi, Semper, 1868.

Tentacles fourteen to sixteen. Digits of the tentacles united by a web. Numerous Polian vesicles. Anchor-arms smooth. Anchor-plates with seven large dentate holes, and two large and several minute smooth holes at the handle; the seventh hole only partly dentate. Anchors often deformed. Miliary granules—rosettes.

Habitat.—Navigator Islands (Semper), Mauritius (Haacke, Ludwig).

(Mus. Holm.) One individual 310 mm. long obtained at the Pelew Islands. Tentacles fourteen, with the numerous small digits, as it seems, united by a thin web. Colour light yellowish or whitish-grey, with a darker line along each of the dorsal ambulacra, and with scattered rather large spots of a greenish-brown colour on the three dorsal interambulacra. Rosette-shaped granules numerous. Cartilaginous ring absent. Deposits and inner organisation fully agreeing with Semper's description.

Synapta polii, Ludwig, 1875.

Digits of the tentacles, about sixty, free. Numerous Polian vesicles. Anchor-arms smooth. Anchor-plates with six large dentate holes, and three large and some minute smooth holes. Miliary granules—rosettes.

Habitat.—Barbados (Ludwig).

This species must be very nearly allied, if not identical, to Müller's *Synapta lappa*.

The following species, probably belonging to the same group of Synaptæ, are unsatisfactorily known and need to be re-examined :—

Synapta bifaria, Semper, 1868. *Synapta* sp., Herapath, 1865.

Tentacles in two crowns, those in the exterior digitate or pinnate, those in the inner, on the contrary, simple unbranched.

Habitat.—Belfast in Ireland (Herapath).

Synapta radiosa (*Holothuria*), Reynaud, Lesson, 1830; Jæger, 1833; J. Müller, 1854. *Reynaudia* (?) *radiosa*, Brandt, 1835.

Very incompletely described. Probably identical with *Synapta beselii*.

Habitat.—Coromandel, at the Bay of Bengal (Lesson).

Synapta tentaculata (*Holothuria*), Forster, Blainville, 1821; Semper, 1868. *Pentacta tentaculata*, Jæger, 1833. *Cucumaria tentaculata*, Blainville, 1834. *Oncinolabes forsteri*, Brandt, 1835.

Very incomplete description. Probably nearly related to the group of *Synapta beselii*.

Habitat.—Rogit, Massachusetts (Blainville and Forster).

Synapta maculata (*Holothuria*), Chamisso and Eysenhardt, 1821; Jæger, 1833. *Fistularia maculata*, Blainville, 1834.

Very incomplete description. Related to *Synapta vittata, Synapta serpentina*, &c.
Habitat.—Radack (Cham. and Eysenh.).

Synapta mamillosa, Eschscholtz, 1829.

Very incomplete description. Possibly to be referred to *Synapta beselii.*
Habitat.—Society Islands (Eschsch.).

Synapta fasciata, Kuhl and van Hasselt, 1869; Ludwig, 1875.

Incomplete description. Related to *Synapta beselii.*
Habitat.—Java (Kuhl and Hasselt).

Synapta punctulata (*Fistularia*), Quoy and Gaimard, 1833; Brandt, 1835.

Very unsatisfactory description. Tentacles fifteen. Body papilliferous.
Habitat.—Port Dorey in New Guinea (Quoy and Gaimard).

Synapta doreyana (*Fistularia*), Quoy and Gaimard, 1833; Brandt, 1835.

Unsatisfactory description. Tentacles fifteen. Four series of rigid tubercles. Related to *Synapta beselii.*
Habitat.—Port Dorey in New Guinea (Quoy and Gaimard).

Synapta fusca (*Fistularia*), Quoy and Gaimard, 1833; Selenka, 1867. *Chirodota fusca*, Brandt, 1835.

Unsatisfactory description. Tentacles sixteen. Body smooth.
Habitat.—Carteret in New Ireland (Quoy and Gaimard).

Synapta reciprocans (*Fistularia*), Forskaal, 1775; Jæger, 1833. *Holothuria glutinosa*, Lamarck, 1816.

Habitat.—Suez (Forskaal), Red Sea (Gray).

Synapta rappardii, Held, 1857.

Habitat?

Synapta zebrina, Held, 1857.

Habitat?

IV. Tentacles thirteen.

Synapta indivisa, Semper, 1868.

Tentacles with about twenty very long, slender digits. Cartilaginous ring absent (?). Three Polian vesicles. A single madreporic canal. Anchor-arms smooth. Anchor-plates with six larger dentate holes, and three larger and some smaller smooth holes. Miliary granules rosette-shaped.

Habitat.—Samboangan, Mindanao (Semper).

Synapta recta, Semper, 1868.

Tentacles with very short digits. Cartilaginous ring present, with holes posteriorly. Nine long and three or four shorter Polian vesicles. A single madreporic canal. Deposits like those in the preceding species. Especially distinguished by the intestine not forming convolutions.

Habitat.—Bohol (Semper).

V. Tentacles twelve.

Synapta inhærens (*Holothuria*), O. F. Müller, 1788 ; Rathke, 1843 ; Düben and Koren, 1844 (*partim*) ; J. Müller, 1850. *Pentacta inhærens*, Jæger, 1833. *Cucumaria inhærens*, Blainville, 1834. *Dactylota inhærens*, Brandt, 1835. *Chirodota pinnata*, Grube, 1840. *Synapta duvernæa*, Quatrefages, 1842. *Synapta henslowana*, Gray, 1848. *Synapta girardii*, Pourtalès, 1851. *Synapta tenuis*, Ayres, 1854. *Synapta pellucida*, Stimpson and Kürtz, Ayres, 1854. *Synapta galliennii*, Herapath, 1865. *Synapta ayresii*, Selenka, 1867. *Leptosynapta tenuis*, Verrill, 1867–1871. *Synapta saruiensis*, Ray Lankester, 1868. *Leptosynapta inhærens*, Verrill, 1867–1871. *Leptosynapta girardii*, Verrill, 1874.

Tentacles with eleven to fifteen digits. Cartilaginous ring none. One to three Polian vesicles. A single madreporic canal. Anchor-arms dentate. Anchor-plates ovate, narrower towards the attachment to the anchor, but without any true narrow handle, with seven larger dentate holes and several larger and smaller smooth holes at the narrower end. Miliary granules present.

Habitat.—Scandinavian coasts from the Sound to Finmark (Düben and Koren, Danielsen, M. Sars, Rathke, Möbius, Ludwig, O. F. Müller, Danielsen and Koren), White Sea (Jarzynsky), British Islands (Woodward and Barret, Ray Lankester, Kinahan, Brady and Robertson, Thompson, M'Intosh, Norman, Herapath, Möbius and Bütschli, Herdman, Leslie and Herdman, &c.); North Atlantic Ocean between Scotland and Norway (Möbius and Bütschli), West coast of France (Quatrefages, Fischer, Barrois), Mediterranean Sea (J. Müller, Ludwig, &c.), New Jersey to Massachusetts Bay (Verrill, Pourtalès), Boston Harbour, Bird Island, Sag Harbour, South Carolina (Ayres). N. Carolina (Coues and Yarrow).

("Porcupine" Expedition). Three specimens from Station 35, July 26, 1869; depth, 96 fathoms.

(Mus. Holm.) Several specimens of Verrill's *Leptosynapta girardii* dredged at Newport. The miliary granules resemble minute curved or straight rods with one or both ends enlarged; sometimes they even have the shape of very incomplete rosettes.

Synapta gracilis, Selenka, 1867.

Tentacles with ten to twelve digits. Cartilaginous ring none. A single Polian vesicle and madreporic canal. In young individuals the anchors and plates are opaque and consist of arragonite crystals. In older forms the deposits always present a distinct roughness, but the arms of the anchors are transparent and dentate. The holes of the plates are minutely dentate. Tentacles without calcareous rods in the walls.

Habitat.—Massachusetts Bay (Selenka).

This species seems very doubtful. Selenka's figures give the impression of being drawn from deposits in a state of dissolution. Doubtless it is identical with the preceding species, to which the deposits bear a certain resemblance. Miliary granules unknown.

Synapta roseola (*Leptosynapta*), Verrill, 1874.

Habitat.—Long Island Sound and Vineyard Sound (Verrill), Provincetown and Cape Cod (Rathbun).

The species differs from *Synapta inhærens* mainly by the colour being rosy or pale red, due to minute red spots. Is doubtless not a distinct species.

Synapta albicans, Selenka, 1867.

Tentacles with about twenty-one digits. Cartilaginous ring absent. A single Polian vesicle and madreporic canal. Anchor-arms dentate. Anchor-plates with the usual number (seven) of large dentate holes and several almost smooth ones. Tentacles with numerous rods. Intestinal canal without circumvolutions (?).

Habitat.—Mendocino in California (Selenka).

Even this species seems not to be well defined. Miliary granules unknown.

Synapta ooplax, von Marenzeller, 1881.

Tentacles with nine, seldom eleven digits. Cartilaginous ring none. A single Polian vesicle and madreporic canal. Anchor-arms with two to three serrations. Anchor-plates ovate, with almost smooth margin, and with holes either smooth or dentate. Miliary granules present on the ambulacra—oval disciform with or without a central opening or slightly curved.

Habitat.—Japan or China (v. Marenzeller).

The following forms are more or less imperfectly known and need to be re-examined. They seem to belong to the same group as *Synapta inhærens*.

Synapta viridis (*Holothuria*), Lesueur, 1824; Lamarck, 1840. *Heterosynapta viridis*, Verrill, 1867–1871.

Tentacles unequal, eight larger with twelve to fourteen digits (pennatulæ), and four smaller destitute of digits. Body covered with small prehensile tubercles. Deposits unknown.

Habitat.—St. Thomas (Lesueur).

Synapta hydriformis (*Holothuria*), Lesueur, 1824; Lamarck, 1840. *Leptosynapta hydriformis*, Verrill, 1867–1871.

Tentacles twelve, equal, with twelve to fourteen digits, united at the base by a diaphanous membrane. Body furnished with very small, distant tubercles. Deposits unknown.

Habitat.—Guadaloupe (Lesueur).

Synapta verrucosa (*Chirodota*), Eschscholtz, 1829; Grube, 1850. *Leptosynapta verrucosa*, Verrill, 1867–1871.

Number of tentacles unknown. Each tentacle with nine digits; the terminal digit longer than the rest. Body covered with small reddish warts. Deposits unknown.

Habitat.—Sitcha (Eschscholtz).

Synapta lumbricoides (*Chirodota*), Eschscholtz, 1829; Grube, 1850.

Number of tentacles unknown. Each tentacle with eleven digits of almost equal size. Deposits unknown.

Habitat.—Radak (Eschscholtz).

Synapta pourtalesii, Selenka, 1867. *Synapta viridis*, Pourtalès, 1851. *Leptosynapta pourtalesii*, Verrill, 1867–1871.

Tentacles twelve, with about twenty digits. Deposits nearly of the same shape as those in *Synapta inhærens*.

Habitat.—Biscayne Bay in Florida (Pourtalès).

The species must be very nearly allied to *Synapta inhærens*.

Synapta dolabrifera, Stimpson, 1856.

Tentacles twelve, with about fourteen digits. Deposits crowded. Anchor-plates mostly with ten perforations, the middle largest. Anchors a little larger than the plates, with the extremity of the handle also provided with a double hook, though of very small size.

Habitat.—Port Jackson (Stimpson).

Synapta oceanica (*Holothuria*), Lesson, 1830; Jæger, 1833.

Tentacles ten, flat, pinnate or plumulose. Six membranous bands along the body; symmetrical, round protuberances occupy the intervals between these bands. Anchors present. Very unsatisfactory description.

Habitat.—Very common at Tahiti (Lesson).

There is no doubt that the above description is very incorrect. Lesson speaks wrongly of six longitudinal bands, and there is reason to believe that he also erred when stating the tentacles to be ten. Judging from the pinnate tentacles, from the presence of longitudinal series of round protuberances, from the length (3 feet) of the body, and, finally, from the locality itself, where the animal is found in abundance, I am much inclined to refer the species of Lesson to Jæger's *Synapta beselii*, which is known to be common at the Society Islands. Selenka and Semper referred Lesson's species to those with twelve tentacles.

VI. Tentacles ten.

Synapta reticulata, Semper, 1868.

Tentacles with ten to twelve thick, distant digits. Cartilaginous ring present, with large holes posteriorly. Polian vesicles eight to ten. Madreporic canal single. Anchor-arms smooth. Anchor-plates symmetrical, with seven larger dentate holes and some smaller smooth ones. Miliary granules rosette-shaped.

Habitat.—Bohol (Semper).

B. Tentacles digitate, with few, never more than five digits. Anchor-plates, almost without exception, asymmetrical, with numerous often smooth holes, which for the most part are irregularly arranged; very seldom a handle at the articular end, which is often more or less distinctly truncated, and has the bow indistinct or even absent. Circumference of the plates mostly uneven or incomplete.

I. Tentacles thirteen.

Synapta uncinata, Hutton, 1872.

Tentacles very short, merely tubercles, with two incurved hooks at the end of each. Anchor-flukes equal. Very unsatisfactory description.

Habitat.—New Zealand (Hutton).

II. Tentacles twelve, with four digits.

1. *Anchors very asymmetrical, one of the arms being smaller and bent toward the shank so as to form a more acute angle with it than does the longer arm.*

Synapta petersi, Semper, 1868.

The short anchor-arm with three to four serrations. The long anchor-arm smooth, forming an obtuse rounded angle with the shank. Anchor-handle with irregular processes. Anchor-plates with uneven margin, smooth holes, and without any marked handle. Miliary granules minute, × -shaped. Inner organs unknown.

Habitat.—Amboina (Semper).

Synapta asymmetrica, Ludwig, 1875.

Anchor-arms smooth or serrated. The shorter arm forms a considerably sharper angle with the shank than the longer. Anchor-handle without processes, often curved. Anchor-plates with smooth or slightly dentate margin, with very numerous dentate holes, and without any marked handle. Miliary granules—small, regular plates, with four dentate holes. Four Polian vesicles. A single madreporic canal.

Habitat.—Banka at Sunda Islands (Ludwig).

(Mus. Holm.) One specimen obtained at Banka, agreeing in all respects with the description of Ludwig.

2. *Anchors almost symmetrical.*

a. Anchor-plates oval or elongate with a distinct narrow handle, almost complete margin and comparatively fewer holes.

Synapta dubia, Semper, 1868.

Anchor-arms smooth. Anchor-plates more elongate, irregularly perforated, with even margin and smooth unequal holes, and with some small holes in the narrow handle. Miliary granules × -shaped. Inner organs unknown.

Habitat.—Bohol and Cebu (Semper).

Synapta incerta, Ludwig, 1875.

Anchor-arms serrated. Anchor-plates like those in the preceding species, but more symmetrically formed. Miliary granules—minute rods curved like brackets. Tentacles and inner organs unknown.

Habitat.—Banka at Sunda Islands (Ludwig).

Considering that the tentacles are unknown, this species may possibly be referred to the group with five digits in each tentacle.

b. Anchor-plates more or less irregularly rounded, without any marked handle, with uneven or incomplete margin and smooth rather numerous holes.

Synapta bidentata, Woodward and Barrett, 1858.

Anchor-arms smooth but bifid. Anchor-plates obovate, truncated at the articular end, and with numerous holes. Miliary granules rather large, very numerous, resembling cruciform fragments of anchor-plates. Inner organs unknown.

Habitat.—China (W. and B.).

Synapta molesta, Semper, 1868.

Anchors small, and as it were undeveloped. Anchor-arms smooth, not bifid. Anchor-plates very irregular, without bow. Miliary granules cruciform or resembling minute irregular plates pierced by a few holes. A single madreporic canal. Four long Polian vesicles.

Habitat.—Bohol (Semper).

III. Tentacles twelve, with five digits, the terminal one being more or less inconsiderable.

Synapta digitata (*Holothuria*), Montagu, 1815; Müller, 1850 and 1852; Baur, 1864; Woodward and Barrett, 1858. *Fistularia digitata*, Lamarck, 1816. *Holothuria inhærens*, Delle Chiaje, 1823. *Mülleria digitata*, Fleming, 1828. *Thyone digitata*, Blainville, 1834. *Chirodota chiaii*, Grube, 1840. *Chirodota digitata*, Forbes, 1841. *Synapta digitata*, var. *thompsoni*, Herapath, 1865; Barrois, 1882.

Anchors slightly unequal in size. Anchor-arms smooth or with some serrations. Anchor-plates slightly elongate, with a marked narrow handle, almost like that in Semper's *Synapta dubia*, irregularly perforated and with the holes smooth. Miliary granules numerous, oblong or hour-glass shaped, especially crowded over the muscular bands. Madreporic canal and Polian vesicle single.

Habitat.—British Islands (Montagu, Woodward and Barrett, Thompson, Kinahan, Forbes, &c.), France (Barrois, Fischer), Spain, at Vigo Bay (Woodward and Barrett), Mediterranean Sea (Ludwig, Sars, J. Müller, Grube, Heller, &c.).

Synapta benedeni, Ludwig, 1881 and 1882.

Anchor-arms with some small, obtuse serrations. Anchor-plates slightly elongate, truncated at the articular end, thus in want of handle, with uneven margin and the numerous holes sparingly dentate in their margin. Miliary granules numerous, small, rod-like. Six Polian vesicles and a single dorsal madreporic canal.

Habitat.—Brazil (Ludwig).

IV. Tentacles constantly eleven.

Synapta tenera, Norman, 1864 (no description); M'Intosh, 1875; Brady and Robertson, 1871. (*?*) *Synapta inhærens*, Düben and Koren, 1844 (*partim*). *Synapta buskii*, M'Intosh, 1865–1866.

Each of the eleven tentacles with three slender digits of almost equal length, or the terminal slightly larger; behind these digits two or three transverse ridges may be found, by means of which the tentacles get the appearance of having two or three pairs of short, obtuse processes behind the above-mentioned digits. These processes are not, however, true digits. Anchors with serrations on the arms. Anchor-plates rather characteristic, and differing from those of any other Holothurids; they are very symmetrical, rounded, hexagonal, with a long narrow handle, which has regularly two small smooth perforations; the plates themselves are pierced by seven dentate holes, of which that close to the handle is slightly smaller, transverse in position, and curvate. By means of those very symmetrically formed plates *Synapta tenera* approaches the group of Synaptæ with numerous digits on the tentacles. No miliary granules (?). Body is most translucent, and of a pale flesh colour. Polian vesicle and madreporic canal single. Length about 35 mm.

Habitat.—British Islands (Norman, Brady and Robertson, M'Intosh), Sognefjord in Norway (Danielssen and Koren).

(Mus. Holm.) A very great number of specimens from the west coast of Sweden, where it is one of the most common animals, on a bottom of muddy clay.

V. Tentacles ten, each with four digits and a small terminal tubercle.

Synapta similis, Semper, 1868.

Anchor-arms with serrations. Anchor-plates irregularly rounded with incomplete margin, and without handle but with numerous smooth holes. Miliary granules rod-like, cruciform. One to two Polian vesicles. A single madreporic canal.

Habitat.—Bohol (Semper).

VI. Tentacles and inner organs unknown, only fragments of animals having been examined.

1. *Anchors of two kinds, viz., large and small.*

a. Holes of the anchor-plates dentate.

Synapta bankensis, Ludwig, 1875.

Anchor-arms serrate. The smaller anchors and their plates are a fifth or a sixth of the larger. Anchor-plates roundish ovate, rather symmetrical, sparingly serrated in their almost even circumference, and with very numerous, small, dentate holes; no handle. Miliary granules minute, rounded or biscuit-shaped.

Habitat.—Banka (Ludwig).

(Mus. Holm.) One incomplete specimen dredged at Banka, agreeing nearly in all respects with the description of Ludwig. I only find that the small anchor-plates are more irregular, and provided with comparatively larger and fewer holes than the larger plates, and that often some of the central holes are considerably larger than the rest.

Synapta innominata, Ludwig, 1875.

The larger anchors, present only in the five ambulacra, are more than twice as long as the smaller. Arms of the smaller anchors with one or two serrations, those of the larger with numerous. Anchor-plates irregularly rounded, with incomplete margin and rather large, slightly dentate, about twenty-five or more holes; no handle. Miliary granules elongate cruciform.

Habitat.—Philippine Islands (Ludwig).

b. Holes of the anchor-plates smooth.

Synapta pseudo-digitata, Semper, 1868.

The larger anchors are more than thrice as long as the smaller. Arms of the larger anchors serrate, while those of the smaller seem to be smooth. Anchor-plates roundish oval, with uneven margin and numerous smooth holes; no handles. Miliary granules—small, elongate, cruciform bodies.

Habitat.—Bohol (Semper).

2. *Anchors of one kind.*

a. Anchor-plates with low ridges or prominences between the holes.

Synapta distincta, von Marenzeller, 1881.

Anchor-arms with minute serrations. Anchor-plates roundish oval, with incomplete margin and numerous smooth holes; no handle. Miliary granules cruciform, with the short arms spinous.

Habitat.—Miya in Japan (von Marenzeller), Amoy (Ludwig).

b. Anchor-plates smooth, without ridges.

Synapta autopista, von Marenzeller, 1881.

Anchors short and robust, with a few larger and smaller serrations at the ends of the arms. Anchor-plates asymmetrical, roundish angular, with uneven incomplete circumference and numerous smooth holes; no handle. Miliary granules, ×-shaped or plate-like with a few holes and knobs.

Habitat.—Miya in Japan (von Marenzeller).

This species does not seem to be well defined. Von Marenzeller remarks that it bears in some respects a certain resemblance to Semper's *Synapta molesta*.

Synapta hispida, Heller, 1868.

Anchor-arms smooth. Anchor-plates oval with slightly uneven margin and numerous (about 28) smooth holes; no handle. Present some similarity to *Synapta digitata*

Habitat.—Lesina (Adriatic Sea), Heller.

The following species are quite unknown as regards internal and external organisation :—

Synapta inæqualis, Hutton, 1872.

Habitat.—New Zealand (Hutton).

One of the anchor-arms being much longer than the other, this species may possibly be nearly allied to Ludwig's *Synapta asymmetrica*.

Synapta bachei (?), Ayres, 1854.

Habitat ?

(?) *Synapta vivipara* (*Synaptula*), Œrsted, 1851 ; Ludwig, 1881.

Habitat.—West Indies (Œrsted).

Nothing is known of this animal excepting that it is provided with anchors, and is viviparous. Agreeing with the views of Ludwig, I cannot consider a genus justified only on account of its representatives being viviparous. Therefore I think it most proper, for the present, to refer the species of Œrsted to *Synapta* or *Chirodota*, and to omit his genus *Synaptula*.

Genus 4. Chirodota, Eschscholtz, 1829.

Tentacles ten to twenty, peltate digitate. Deposits—groups of wheels, enclosed within warts in the integument, and, besides, often small more or less curved rods or S-shaped bodies. Wheels regularly with six spokes. Exceptionally S-shaped bodies alone present. Hermaphrodite.

A. No wheels, only S-shaped bodies.

Chirodota japonica, von Marenzeller, 1881.

Tentacles ten, with fourteen to sixteen digits. A single Polian vesicle. S-shaped bodies collected in heaps, four to seven in each, with their curled end directed towards the periphery of the heaps.

Habitat.—Eno-Sima, Japan (v. Marenzeller).

Chirodota studerii, Théel. *Sigmodota purpurea*, Studer, 1877. *Chirodota purpurea*, J. Bell, 1881.

Tentacles twelve, digitiform. S-shaped bodies rare.

Habitat.—Kerguelen Islands and Strait of Magellan (Studer), Elizabeth Island (Jeffrey Bell).

For reasons given above in the text, I think it most credible that the species of Studer is distinct from that of Lesson, therefore the specific name *purpurea* must be kept for Lesson's species. Compare even my remarks in the text under *Chirodota contorta*. The description of Studer is very brief.

Chirodota ferruginea (*Toxodora*), Verrill, 1882.

Tentacles twelve, with numerous digitations. Skin thin, somewhat translucent, filled with minute reddish-brown pigment-cells, and having numerous, minute, slender plates in the shape of a bow, or a parenthesis, with the ends incurved.

Habitat.—Southern coast of New England (Verrill).

On reading the summary description of Verrill, it is impossible to find any definite distinction between this species and the preceding one.

B. Wheels together with S-shaped bodies.

Chirodota contorta, Ludwig, 1875.

Tentacles twelve, with thirteen to fourteen digits. Six to seven Polian vesicles. The wheel papillæ irregularly scattered over the interambulacra, more numerous on the bivium and in the anterior part of the body.

Habitat?

Chirodota australiana, Stimpson, 1856.

Tentacles ten, each with ten serrulated digits. Body with two kinds of papillæ, the smaller, spread everywhere, consisting of accumulations of spicules which are hooked at one extremity and slightly bent at the other; the larger, white ones consist of accumulations of wheels and are scattered, quite thickly, along one side of the body only.

Habitat.—Port Jackson (Stimpson).

C. Wheels alone or in company with minute grains or half-moon-shaped bodies.

I. Tentacles ten.

Chirodota dunedinensis, Jeffrey Parker, 1881.

Each of the tentacles with about ten digits. Calcareous spicules in the form of wheels. Description not very satisfactory.

Habitat.—Otago Harbour, New Zealand (Parker).

II. Tentacles twelve.

1. *Digits of the tentacles numerous, about twenty.*

Chirodota violacea, Peters, Müller, 1849, 1850, 1854.

Wheel-papillæ arranged in five irregular series. Besides the wheels, numerous minute grains in the shape of half-moons. One or more Polian vesicles.

Habitat.—Mozambique (Müller).

2. *Digits of the tentacles few, rarely more than thirteen.*

Chirodota lævis (*Holothuria*), Fabricius, 1780; Grube, 1850; Lütken, 1857; Duncan and Sladen, 1881. *Holothuria pellucida*, Vahl, O. F. Müller, 1788–1806. *Pentacta pellucida*, Jæger, 1833. *Pentacta lævis*, Jæger, 1833. *Cucumaria pellucida*, Blainville, 1834. *Cucumaria lævis*, Blainville, 1834. *Dactylota pellucida*, Brandt, 1835. *Dactylota lævis*, Brandt, 1835. (?) *Thyonidium pellucidum*, Sars, 1851. (?) *Synapta coriacea*, Agassiz, 1852. (?) *Trochinus pallidus*, Ayres, 1854. (?) *Chirodota tigillum*, Selenka, 1867. (?) *Chirodota typica*, Selenka, 1867.

Each of the tentacles with ten to twelve digits. Wheel-papillæ twenty to thirty in each of the three dorsal interambulacra, three to twelve in the two ventral interambulacra, the two latter being always naked in their middle. Polian vesicles several (ten to fourteen or more). Neither Sars nor Duncan and Sladen seem to have found any other deposits in the integument than wheels.

Habitat.—North-west coast of Norway at Nordlanden and Lofoten (Vahl, Sars), White Sea (Jarzynsky), Spitzbergen (Ljungman), Greenland (Lütken, Duncan and Sladen,

Norman, Ludwig, Fabricius, Stimpson, &c.), north of American continent, viz., Fundy Bay (Stimpson), (?) Massachusetts Bay (Selenka), East Port (Selenka, Ayres, Verrill), Labrador and Grand Manan (Verrill).

(Mus. Holm.) Numerous specimens from different localities of the Arctic Sea.

Chirodota rotifera (*Synapta*), Pourtalès, 1851; Stimpson, 1860; Verrill, 1867–1871; Ludwig, 1881 and 1882.

Each of the tentacles with twelve, or fewer, digits. Wheel-papillæ scattered all over the interambulacra. Polian vesicles several. Besides the wheels, a few slightly curved rods with the ends slightly enlarged and uneven.

Habitat.—Biscayne Bay, Florida (Pourtalès), Brazil (Ludwig), Bahia and Abrolhos Reefs (Rathbun and Verrill).

According to Ludwig the colour is whitish, while the specimens examined by Pourtalès and Verrill were of a light purplish colour and have only eight to ten digits on each tentacle. The species in question differs from the preceding one mainly by its being viviparous (according to Ludwig), by the presence of curved ribs besides wheels, and by the arrangement of the ciliated cups. Notwithstanding this, the two species must be very nearly allied.

Chirodota rigida, Semper, 1868.

Tentacles with about thirteen digits. Crowded whitish wheel-papillæ on the dorsal interambulacra; simple rows of them along the ventral interambulacra. Besides the wheels, curved rods with the ends slightly spinous. Four large and ten to twelve small Polian vesicles.

Habitat.—Bohol, Philippine Islands (Semper).

Chirodota pygmæa, Müller, 1850.

Tentacles with eight digits. Wheel-papillæ arranged in five irregular series. Several Polian vesicles.

Habitat? According to Verrill it belongs to the Caribbean fauna, but Müller himself supposes it to have been dredged in the Mediterranean Sea. The species is imperfectly known, possibly identical with one of the preceding forms.

Chirodota eximia, Haacke, 1880.

Tentacles with seven digits. Wheel-papillæ arranged in five simple interradial rows. Besides the wheels, numerous buttons (= schnallenförmiger Hautkalkkörper).

Habitat.—Mauritius (Haacke).

Chirodota purpurea (*Holothuria, Fistularia*), Lesson, 1830; Jæger, 1833.

Habitat.—Soledad in Falkland Islands (Lesson).

Compare the description given in the text concerning the Challenger specimens. According to Lesson, only ten tentacles, each with six digits, are present, but

this may probably depend upon some error in the determination. In general, the descriptions of Lesson are very defective, but even he mentions the small tube-like tubercles on the dorsal surface, observed by myself in the Challenger specimens.

As a rule, the species of the genus *Chirodota* are very difficult to distinguish from each other. The one form passes imperceptibly into the other in such a manner that no special specific characteristics can be drawn up. The representatives of this genus are, as it were, in a state of evolution, only few species having been hitherto differentiated. However, our present knowledge is too unsatisfactory to decide on the validity of several so-called specific characters. The number of tentacles and digits as well as the colour, the arrangement of the wheel-papillæ, &c., seem to be subject to great variation. If this be so, it may follow, for instance, that *Chirodota purpurea* is the Antarctic form of the Arctic *Chirodota pellucida*, and that *Chirodota rotifera* of Pourtalès unites these two extremes.

III. Tentacles fifteen to twenty.

Chirodota discolor, Eschscholtz, 1829; Grube, 1850 and 1851; Ludwig, 1881. *Liosoma sitchaense*, Brandt, 1835 (according to Ludwig).

Tentacles twelve (seldom eleven or fifteen), each with twelve to fourteen digits. A row of white papillæ along three of the interambulacra.

Habitat.—Sitka (Brandt and Eschscholtz), Sea of Okotsk (Grube).

Chirodota incongrua, Semper, 1868.

Tentacles sixteen, each with eighteen to twenty digits. Wheel-papillæ in five not very crowded interambulacral rows. Six larger and two smaller Polian vesicles.

Habitat.—Camiguin in Philippine Islands (Semper).

Chirodota variabilis, Semper, 1868; Ludwig, 1881. *Chirodota refuscens*, Brandt, 1835 (according to Ludwig [1]).

Tentacles seventeen to eighteen, each with twenty-two to twenty-four digits. Wheel-papillæ equally distributed all over the body. Six to twelve Polian vesicles. Besides the wheels, slightly curved ribs or rods are present, with the serrate ends slightly enlarged.

Habitat.—Mariveles, Philippine Islands, and Cape York (Semper), Bonin Island (Brandt), Sunda Strait (Sluiter), Hong Kong (Ludwig), Japan, Timor, and Batavia (Ludwig).

The specimen obtained from Australia differs slightly with regard to its tentacles and deposits, whence Semper considers it as a variety.

(Mus. Holm.) One individual with seventeen tentacles, dredged at Singapore.

[1] According to Ludwig, *Aspidochir mertensii* of Brandt is either a *Synapta* or a *Chirodota*. It is captured at Sitcha.

Chirodota vitiensis, Gräffe, Semper, 1868.

Tentacles eighteen, each with twenty digits. Wheel-papillæ much more thinly scattered on the two ventral interambulacra. Six large and three small Polian vesicles. Especially characterised by the smallness of the calcareous ring.

Habitat.—Fiji Islands (Semper).

Chirodota dubia, Semper, 1868.

Tentacles eighteen, each with eighteen to twenty digits. Wheel-papillæ scattered all over the body. Five larger and three smaller Polian vesicles. Besides the wheels, small ribs or rods.

Habitat.—Camiguin in Philippine Islands (Semper), Ceylon (Walter).

So far as I can discover, this species is very closely allied to *Chirodota variabilis*, *Chirodota incongrua*, *Chirodota vitiensis* and possibly even to *Chirodota discolor*, and there seems to be good reason for the supposition that they are varieties of the same species.

Chirodota panaensis, Semper, 1868.

Tentacles nineteen, each with thirty to thirty-two digits. Wheel-papillæ scattered all over the body. Three larger and five to seven smaller Polian vesicles. Besides the wheels, small oval or elongate rods.

Habitat.—Philippine Islands (Semper).

Chirodota rubeola (*Fistularia*), Quoy and Gaimard, 1833; Selenka, 1867.

Tentacles twenty. Body smooth. Description very unsatisfactory.

Habitat.—New Ireland (Quoy and Gaimard).

Genus 5. Myriotrochus, Steenstrup, 1851.

Tentacles twelve, digitate. Deposits—large, free, scattered wheels with numerous (as many as nineteen) spokes and about as many rather large triangular teeth, directed inwards from the margin. Sexes distinct.

Myriotrochus rinkii, Steenstrup, 1852; Lütken, 1857; Théel, 1877; Danielssen and Koren, 1879 and 1882; Duncan and Sladen, 1881. (?) *Chirodota brevis*, Huxley, 1852. (?) *Oligotrochus vitreus*, M. Sars, 1866, and G. O. Sars, 1871. *Myriotrochus vitreus*, Duncan and Sladen, 1881.

Habitat.—Coast of Norway from Christiania Fjord to the Arctic Sea north of Norway (Sars, Storm, Danielssen and Koren), Nova Zembla and Sea of Kara (Théel, Stuxberg), Spitzbergen (Ljungman, Heuglin, Danielssen and Koren), Barents Sea (Hoffman), Greenland (Steenstrup, Lütken, Norman, Duncan and Sladen,

Möbius, &c.), north of American continent, viz., Assistance Bay (Huxley), Labrador (Verrill), Port Foulke (Stimpson), Discovery Bay (Duncan and Sladen).

(Mus. Holm.) A very great number of specimens from Skagerrak, south of Arendal, Spitzbergen, Greenland, Nova Zembla, Sea of Kara, and the northern coast of Asia. Danielssen and Koren and Duncan and Sladen are of opinion that the forms examined by Steenstrup and Lütken are distinct from those described by Sars and myself, and they base their supposition on the fact that the former have stalked wheels, but not the latter. However, I cannot quite agree with them, whence I think a careful re-examination and comparison necessary. Though I have had the opportunity of studying a very great number of specimens from different localities, I never found stalked wheels, except in specimens which were more or less macerated, whereby the wheels become free from the surrounding tissue and become attached by their centre to threads of connective tissue. However, it may possibly be that the animal possesses the capacity of protruding the wheels with their surrounding tissue beyond the level surface of the skin, but according to my opinion, this may be common to all forms. The specimens obtained at the southern localities are peculiar from the scantiness of wheels.

Genus 6. Acanthotrochus, Danielssen and Koren, 1879 and 1882.

Tentacles twelve, digitate. Deposits—free, scattered wheels of two kinds; the smaller with about twenty-two triangular teeth, directed inwards from the rim and generally furnished with eleven spokes; the larger with eight to eleven spokes and with as many long processes directed outward from the rim. Spokes of the wheels with wing-like margins.

Acanthotrochus mirabilis, Danielssen and Koren, 1879 and 1882.

Habitat.—Between Spitzbergen and Norway. Lat. 73° 47′ N., long. 14° 21′ E.; depth, 767 fathoms; Biloculina clay. Lat. 71° 59′ N., long. 11° 40′ E; depth, 1110 fathoms; Biloculina clay. Lat. 74° 54′ N., long. 14° 53′ E.; depth, 658 fathoms; brown and grey clay (Danielssen and Koren).

Genus 7. Trochoderma, Théel, 1877.

Tentacles ten, digitate. Deposits—crowded, free wheels in several superposed layers with the rim very spinous; the spokes more than six, varying from ten to sixteen.

Trochoderma elegans, Théel, 1877.

Habitat.—Nova Zembla and Sea of Kara (Théel, Stuxberg).

Suborder II. PNEUMONOPHORA.

Respiratory-trees present. Radial ambulacral vessels present or not.

Family, Molpadidæ.

Genus *Ankyroderma*, Danielssen and Koren, 1879 and 1882.

Ankyroderma danielsseni, n. sp. (Pl. II. fig. 6).

Body fusiform, anteriorly truncated, posteriorly diminishing into a narrow caudal portion. Tentacles fifteen (?), retracted, very short, each with a pair of minute processes near the rounded end. Anal processes or teeth absent. Calcareous ring almost resembling that in *Trochostoma violaceum*. Polian vesicle single. Madreporic canal single, terminating within a tubercle, attached to the body-wall in the medio-dorsal line. Fifteen long slender tentacular vesicles. The longitudinal muscular bands double, and without retractors. Respiratory-trees two, the left considerably longer than the right one, and anteriorly reaching the gullet and calcareous ring and attached to them. The two fascicles of the reproductive organs very thin, and consisting of a few elongate slightly branched sacs. Integument thin and rough, with several kinds of deposits—numerous smaller and larger, rounded or oval bodies of a reddish-brown colour, aggregated into closely lying groups; numerous long fusiform straight or slightly curved rods with the centre slightly enlarged and perforated, but without any central process; smaller, more scattered, irregular perforated plates with two or more shorter arms, and with a long central process directed straight outwards from the body; and spoon-like rods, with one end enlarged and perforated, collected into groups of six to seven in each, and overlapping one another with the enlarged ends, each group presenting thus the aspect of a star. From the centre of these stars, which are very scattered, a long central anchor-shaped rod rises, directed straight outwards and supported by a round perforated disk-like base. Length of the individual about 75 mm. Colour in alcohol greyish-violet with numerous reddish-brown spots; the foremost and hindmost portions of the body whitish-grey.

Habitat.—Station 310, January 10, 1876; lat. 51° 27′ 30″ S., long. 74° 3′ W.; depth, 400 fathoms; bottom temperature, 46·5; blue mud; a single individual.

This species, doubtless very nearly related to the three previously known forms of the same genus, viz., *Ankyroderma jeffreysii* and *Ankyroderma affine*, Danielssen and Koren, and *Ankyroderma roretzii*, v. Marenzeller, differs from them particularly in the possession of the numerous very long smooth fusiform bodies as well as in the shape of the central anchor-rod of the star-like deposits, which is supported by a disk-like perforated base.

The reddish deposits (Pl. II. fig. 6, *h*) resemble those in *Trochostoma violaceum*, though generally smaller. The fusiform rods (Pl. II. fig. 6, *d*) also bear a strong resemblance to those in the species just mentioned. Having a length of as much as 1·4 mm. or more, they are very closely crowded side by side in the anterior and posterior portions of the body, while at the middle of the body they are more separated from one another as well as of a more irregular form. They are quite smooth, and their enlarged centre is pierced by three to nine holes of varying size. Sometimes a third arm runs out from the centre; as a rule, these fusiform or three-armed deposits appear to be more irregular than is the case in *Trochostoma violaceum*.

The smaller, perforated plates (Pl. II. fig. 6, *e*) are scattered among the former and present a very irregular shape. Generally they are of a more or less rounded or oblong form, with two to four or more short arms or sometimes without such. Reaching a length or diameter of about 0·4 mm., they always carry a long simple central process, the top of which carries some spines. Here and there some very minute deposits are to be found provided with a comparatively long central process which carries at its top several hooks (Pl. II. fig. 6, *f.g.*). The spoon-like deposits (Pl. II. fig. 6, *a*) and their mutual position will be best understood by a glance at the figures. They are generally aggregated, five to seven in each group, so as to present the appearance of stars. Each such aggregation is provided with a very long, straight, outwardly directed rod, the base of which (Pl. II. fig. 6, *b*) is round, discoidal, perforated and slightly convex upwards. These central rods are mostly broken off, but when uninjured their tops have the form of anchors with the flukes provided with three or more distinct serrations, thus resembling the anchors found by Danielssen and Koren in *Ankyroderma jeffreysii* and *Ankyroderma affine* (Pl. II. fig. 6, *c*).

Ankyroderma simile, n. sp. (Pl. II. fig. 5; and Pl. XI. fig. 2).

Body fusiform, anteriorly truncated, posteriorly decreasing into a narrow caudal portion. Tentacles fifteen, comparatively large, and provided with a pair of minute processes near the rounded ends. Anus surrounded by five calcareous teeth and fifteen minute cylindrical papillæ, disposed in groups of one tooth and three papillæ in each. Calcareous deposits very scattered—small rounded reddish or light brownish bodies mostly aggregated into smaller masses; small and thinly scattered rings supporting a crown of three to four straight outwardly directed rods; and very thinly dispersed star-like deposits, consisting of about five spoon-like rods, with the enlarged perforated ends overlapping one another, and a long straight outwardly directed central rod, the top of which is provided with two curved arms thus bearing some resemblance to the anchors in *Synapta*. Colour in alcohol dirty grey and yellowish-brown. Length 100 to 110 mm.

Habitat.—Station 232, May 12, 1875; lat. 35° 11′ N., long. 139° 28′ E.; depth, 345 fathoms; bottom temperature, 41·1; green mud; a single individual.

With regard to the inner organisation, *Ankyroderma simile* agrees mostly with the species before known, wherefore I refer to the descriptions of them. The reddish deposits (Pl. II. fig. 5, *c*) are of a more circular form, and considerably smaller than in the other species. The second kind of deposits (Pl. II. fig. 5, *d*) is also of a more insignificant size, and consists of an almost circular disk which is convex outwards, and pierced by three to four holes; from the convex surface of the disk a crown rises, composed of two to four straight or irregularly curved rods which are directed outwards and connected with one another by one or more transverse beams. The diameter of these deposits, which are very scattered, is only 0·064 mm. or less. However, near the posterior extremity of the body the deposits in question become more crowded and present a more irregular elongate form (Pl. II. fig. 5, *e*).

The star-like aggregations of deposits (Pl. II. fig. 5, *a*) are very scattered, and consist of five to six spoon-like rods with the enlarged perforated extremities overlapping one another, and with the handles often uneven, pierced by some minute holes, and split at their ends. Length of the rods up to 0·48 mm. The central anchor-shaped rod runs out from a small basal ring (Pl. II. fig. 5, *b*), and measures in length about 0·4 mm. or more; the flukes are mostly broken off, and appear to be highly curved and rather rough. The teeth which surround the anal aperture are composed of a firm network.

Ankyroderma marenzelleri, n. sp. (Pl. III. fig. 1).

Tentacles fifteen (?), each with three processes, the intermediate one being largest. Calcareous deposits of three different kinds; aggregations of larger and smaller, rounded or oval, yellowish or reddish-brown bodies; perforated plates with about six larger holes and with a long straight outwardly directed crown, composed of three rods connected with one another by several cross-rails, and split at their ends into several branched ends; and more scattered plates of a very singular form, pierced by several minute holes and provided with about three rather long arms. Besides a smaller crown of some spinous processes, these later deposits are always in connection with a straight outwardly directed anchor-shaped rod, the base of which is perforated and discoidal and the flukes provided with one or more serrations. Colour in alcohol, reddish-violet, dappled. Length about 26 mm.

Habitat.—Station 169, July 10, 1874; lat. 37° 34′ S., long. 179° 22′ E.; depth, 700 fathoms; bottom temperature, 40·0; blue mud; a single incomplete individual.

The tentacles are minute and retracted so that I am not quite sure of their number. The caudal portion of the body is broken off. The internal organs seem to be almost identical with those in the previously known species of *Ankyroderma*. The integument

is very rough from the numerous calcareous deposits. The plates, or rather tables, which are by far more numerous than the "anchor-plates," and give to the integument its roughness, have a diameter of up to 0·24 mm. or more. Besides these fully developed deposits, many others are imbedded in the skin representing the different stages of development of the former. The irregularly formed "anchor-plates" may be best understood from the figures; their length is about 0·4 mm. The bodies belonging to the two kinds of deposits above mentioned often have a yellowish-brown colour resembling that of the small rounded or oval bodies, and I have not seldom met with colourless deposits which have begun to change in this respect.

Genus *Trochostoma*, Danielssen and Koren, 1878 and 1882.

Trochostoma violaceum, Studer, 1877 (Pl. II. fig. 4; Pl. XI. fig. 1).

Habitat.—Royal Sound (Kerguelen Islands), 20 to 50 fathoms; numerous individuals. Betsy Cove (Kerguelen Islands), January 9, 1874; lat. 49° 16′ S., long. 70° 12′ E.; depth, 20 to 25 fathoms; one specimen. Christmas Harbour (Kerguelen Islands); depth, 120 fathoms; one specimen. Station 169, July 10, 1874; lat. 37° 34′ S., long. 179° 22′ E.; depth, 700 fathoms; bottom temperature, 40·0; blue mud; one specimen.

The body is fusiform, anteriorly truncated, and gradually decreasing in width towards the posterior end, which becomes rather narrow and is devoid of any processes or teeth. The tentacles, fifteen in number, are very short and provided with a pair of minute processes near their obtuse, round end; they communicate with fifteen long cylindrical tentacular vesicles or ampullæ. Each of the five longitudinal muscles is divided into two bands, and they do not give off any retractors. The calcareous ring (Pl. II. fig. 4, *d*) is built up of ten pieces, five radial and five interradial, which are intimately joined together so as to form a continuous whole. The interradial pieces, which are much smaller, send forwards one process, while the radial ones have two such, one of which is perforated for the nerves. Besides, the radial pieces terminate posteriorly in a large bifurcated process (Pl. XI. fig. 1, *a*), which supports the corresponding canal issuing from the water-vascular ring to the tentacles. Polian vesicle single, about 25 mm. long. The madreporic canal, single and dorsal, terminates in a madreporic tubercle. The reproductive organs are composed of two thin fascicles of long cylindrical sacs, one on each side of the medio-dorsal mesentery. The long common efferent duct opens externally slightly behind the tentacles, viz., between these and the madreporic tubercle. The cloaca communicates with two respiratory-trees, the right of which is generally longer, its cæcal end being often firmly attached to the gullet and the calcareous ring. The pseudhæmal vessels are not brought into connection with the respiratory-trees.

Three different kinds of deposits are to be found in the integument; large fusiform rods, which are sometimes changed into three-armed bodies (Pl. II. fig. 4, *b*); small irregular perforated deposits with a central process (Pl. II. fig. 4, *a*); and round or oval deposits of a wine colour (Pl. II. fig. 4, *c*). The fusiform deposits are very large, measuring up to 1·2 mm. or more in length, and mostly seem to have a transverse position; in the anterior and posterior parts of the body they are very numerous and closely crowded side by side, while at the middle of the body they are much scattered. Near the posterior end of the body the fusiform deposits often present a more irregular form, and it is here that the more or less irregular three-armed deposits are principally found. The slightly enlarged centre of these deposits is always pierced by some small holes. These deposits are quite smooth, and always devoid of spines or central processes. The deposits of the second kind are much smaller, about 0·4 mm. long, and very rare, and scattered so that they easily escape notice; they consist of a central, irregularly rounded or oblong, perforated disk with two or three arms and a central process, directed straight outwards from the body. The top of the process is often rough with minute spines. These deposits communicate to the integument a certain roughness, which, however, is very inconsiderable because of their rarity. The deposits of the third kind present a great variety of forms, from round to elongate or rather fusiform. The largest measure as much as 0·3 mm. or more. They are very numerous all over the body, and present a distinct concentric structure. They are of a brownish or reddish colour, like wine. The largest individual measures as much as 160 mm.

The specimen, brought home from Station 169, agrees, as it seems, in most points with the species of Studer. However, it is smaller, only 70 mm. long, of a lighter colour, and has the anal aperture surrounded by small cylindrical papillæ apparently more than five in number. The tentacles are retracted so as to make it impossible to observe their true form. The deposits of a reddish colour like wine are smaller than in the typical forms. Possibly this individual belongs to a new species, but for the present, from want of necessary material, I must abstain from offering any opinion.

From the summary description given by Studer, Danielssen and Koren[1] have thought themselves justified in referring his species to *Trochostoma* (*Molpadia*) *boreale*, M. Sars. A comparison of the above description with those given by the authors just mentioned, as well as by Sars,[2] will prove clearly that the southern form is different from the northern one.

[1] Echinodermer fra den norske Nordhavs-Expedition, *Nyt Magazin f. Naturvidenskab.*, 1879, Bd. xxv. Hefte ii. pp. 124, 126.

[2] Oversigt af Norges Echinodermer, Christiania, 1861, pp. 116–124, pls. xii., xiii.

Trochostoma antarcticum, n. sp. (Pl. II. fig. 7).

Habitat.—Station 306A, January 2, 1876; lat. 48° 27′ S., long. 74° 30′ W.; depth, 345 fathoms; bottom temperature, 46·0; blue mud; a single individual. Station 307, January 4, 1876; lat. 49° 24′ 30″ S., long. 74° 23′ 30″ W.; depth, 140 fathoms; bottom temperature, 46·0 blue mud; one specimen.

The specimen brought home from Station 306A has a length of about 40 mm. That dredged at Station 307 is much smaller. The only difference I have been able to observe between these forms and the species of von Marenzeller living in the Arctic Sea is found in the calcareous deposits, which are much more regularly constructed in the southern forms. From the scanty materials I must abstain, for the present, from offering any opinion on the validity of the new species proposed by me.

The caudal portion of the body is comparatively short but very narrow, especially in the smaller individual. Some very minute papillæ surround the anal aperture. The tentacles of the larger specimen have only three short processes, while those of the smaller individual seem to be furnished with about five. The tentacles being retracted, it is almost impossible to distinguish their true shape.

According to Danielssen and Koren, the old individuals of *Trochostoma arcticum* have their tentacles provided with five to seven processes, while the young ones carry but three such processes on each tentacle. The integument is thin, transparent, colourless, and very rough from numerous perforated calcareous tables consisting of a perforated disk and a straight outwardly directed long crown generally composed of three rods, which mostly carry spines and are connected with each other by several transverse beams. When fully developed, most of the disks of the tables have six larger holes and are of a more or less distinctly regular star-like form. Here and there a minute table may be found, composed of a triangular disk with three holes and a simple rod-like spire terminating in hooks (Pl. II. fig. 7, *d*). In the posterior part of the body the deposits present a more irregular shape, and often have some smaller holes besides the larger ones. Diameter of the plates up to 0·2 mm. or more. Many different stages in the development of these deposits are to be seen within the integument. No other kind of deposits is present.

Trochostoma albicans, n. sp. (Pl. III. fig. 2; Pl. XI. fig. 3).

Body elongated, anteriorly broadest, suddenly rounded and truncated, gradually tapering posteriorly into a very long slender, narrow, almost cylindrical caudal portion. Tentacles fifteen, short, with their terminal part rounded discoidal and surrounded by four or five short processes. Integument coriaceous or somewhat translucent, very rough, with only one kind of deposits, viz., numerous rather large and irregular perforated

plates, with numerous holes and a central crown built up of three rods. Colour in alcohol, whitish. Length of the largest specimen about 90 mm.

Habitat.—Station 45, May 3, 1873; lat. 38° 34′ N., long. 72° 10′ W.; depth, 1240 fathoms; bottom temperature, 37·2; blue mud; four specimens.

The posterior very narrow part of the caudal portion of the body is always broken off in all the individuals I have had at my disposal, but in the same bottle where they are kept, some caudal portions are left, probably belonging to the animals in question. They are about 30 mm. long, so that the largest specimen must be considerably longer than above noted, if one of these parts really belong to it. The anal aperture is surrounded by five calcareous teeth and a number of minute papillæ, the latter being disposed in a ring exteriorly and around the former. As in *Haplodactyla*, *Ankyroderma*, &c., no retractor muscles are present. The longitudinal muscular bands are divided throughout their whole length. The calcareous ring consists of ten pieces which are so united as to constitute a continuous whole; each radial piece is marked anteriorly by two shorter processes and posteriorly by a large bifid projection; the interradial pieces only possess a single shorter process in their anterior margin. Polian vesicle as well as the madreporic canal single. The respiratory-trees are two in number, with short branches; in one of the individuals the left tree is divided near its base into two parts. The genital tubes numerous, slender, and very narrow.

The calcareous deposits of the integuments are numerous, and especially in the caudal portion closely crowded. In most cases they present a somewhat triangular form, with three, seldom four, central holes larger than the remaining ones. The largest plates measure as much as 0·2 mm. in diameter. From the centre a crown rises, composed of three, seldom four, rods which become connected with one another by several cross-rails and terminate in several processes. The basal parts of these rods constitute the three or four central holes just mentioned, wherefore the plates, when the crown is broken off at the base, present a single large hole in their centre. The five teeth round the anus are formed by a firm calcareous network, and they seem to be provided with two rather long roots, by means of which they are firmly attached to the body-wall. According to Brandt,[1] the genus *Liosoma* as well as its species *Liosoma sitchaense* is characterised by having twelve peltate tentacles, and in 1857 Stimpson[2] describes another form, *Liosoma arenicola*, with fifteen tentacles composed of a short peduncle with four or five digitations at the disk-like summit; these branches being also minutely pinnate towards their extremities. No deposits are known from the integument of the two forms just mentioned. Thus the form of the tentacles should be the only characteristic of importance distinguishing *Liosoma* from, for instance, *Haplodactyla*, *Trochostoma*, and

[1] Prodromus, &c., 1835, p. 58.

[2] On the Crustacea and Echinodermata of the Pacific Shores of North America, *Journ. Boston Soc. Nat. Hist.*, vol. vi. 1857, pp. 85, 86 (extract).

other nearly related genera. Now, Ludwig[1] recently proved that the species of Brandt is identical with *Chirodota discolor*, Eschscholtz, and he also expressed the opinion that the whole genus *Liosoma* must be annulled. There is no doubt that *Trochostoma albicans* agrees most strikingly with regard to the shape of its tentacles with *Liosoma arenicola*, but at the same time its similitude to the genus *Trochostoma* being in all other points very obvious, I have thought myself justified in referring it to that genus. In conformity with the views of Ludwig, it appears to me that the genus *Liosoma* is founded on very secondary characteristics.

Trochostoma albicans, var. *glabra*, nov.

Habitat.—Station 169, July 10, 1874; lat. 37° 34′ S., long. 179° 22′ E.; depth, 700 fathoms; bottom temperature, 40·0; blue mud; a single individual.

Length of the individual, 115 mm. Colour in alcohol, whitish. The only difference existing between the type and its variety, as far as I know, is that the integument of the latter is almost smooth, the calcareous deposits being more scattered than in the former. The tentacles also seem to differ in some degree, their comparatively broad ends sending out on each side a very inconsiderable process, beneath which another pair of minute processes is visible.

Trochostoma sp. (?).

Habitat.—Station 299, December 14, 1875; lat. 33° 31′ S., long. 74° 43′ W.; depth, 2160 fathoms; bottom temperature, 35·2; blue mud; one specimen.

The calcareous deposits of the integument being in a state of dissolution, no description of their true form is possible. Only posteriorly in the caudal portion of the body are deposits left, exhibiting a shape almost identical with that common in *Trochostoma arcticum*, *Trochostoma boreale*, &c. They consist of a perforated disk with two arms, one on each side, and a central crown made up of three or four processes, which are mostly completely dissolved. No coloured deposits are to be seen. Possibly other forms of deposits have existed, though they are dissolved by some impurity in the alcohol. The tentacles are fifteen, retracted, each provided with, as it seems, two small processes. All the internal organs resemble those in the before mentioned species. Colour in alcohol, whitish, inclining to violet. Length about 85 mm.

Trochostoma (?).

Habitat.—Station 309, January 8, 1876; lat. 50° 56′ S., long. 74° 15′ W.; depth, 40 to 140 fathoms; blue mud; fragment of one individual; its generic as well as specific position were impossible to determine.

[1] Revision der Mertens-Brandt'schen Holothurien, 1881, pp. 581–583.

Station 320, February 14, 1876; lat. 37° 17′ S., long. 53° 52′ W.; depth, 600 fathoms; bottom temperature, 37·2; green sand; an incomplete specimen.

Caudina coriacea, Hutton, 1872 and 1879.

Habitat.—Station 167A, June 27, 1874; lat. 41° 4′ S., long. 174° 19′ E.; Queen Charlotte Sound, near Long Island; depth, 10 fathoms; mud; caudal portions of several individuals.

Only larger or smaller parts of the caudal portions of the body having been left, no complete diagnosis is possible, and for the same reason I cannot be quite sure of the genus to which it belongs. The integument is very firm, coriaceous, and hard, from numerous closely crowded deposits. Anus is surrounded by five groups of elongate papillæ, each group with five to seven papillæ. The supporting calcareous substance of one of these papillæ of each group seems often to be more developed and transformed into a kind of tooth built up of a dense and firm network.

The deposits of the body-wall strikingly resemble those in *Caudina ransonnetii*, v. Marenzeller (Pl. III. fig. 4); their diameter is as much as 0·052 mm. The deposits of the anal papillæ differ in a striking manner from those pertaining to the rest of the body. There seems to be but little doubt that these fragments belong to the species of Hutton dredged at the same locality. Having had the opportunity to examine the deposits of his types, I can confirm that they closely resemble those found in the Challenger specimen and those described by v. Marenzeller. I should not hesitate to refer Hutton's and the Challenger specimens to *Caudina ranzonnetii*, but v. Marenzeller does not mention the presence of the anal papillæ with their characteristic deposits (Pl. III. fig. 4*c*.).

SURVEY OF THE GENERA AND SPECIES, HITHERTO KNOWN, REFERRED TO THE APODOUS PNEUMONOPHORA.

Family II. Molpadidæ.

Tentacles simple, unbranched or digitate. Body tapering posteriorly into a narrow, longer or shorter caudal portion. Deposits of various shapes; anchors of a strange appearance very seldom occur, never wheels.

Genus 1. Ankyroderma, Danielssen and Koren, 1879 and 1882.

Retractor muscles absent. Calcareous ring with five bipartite posterior prolongations. Tentacles fifteen, three-lobed. Deposits—excepting other calcareous bodies, anchors in connection with groups of spoon-like rods, or very seldom irregularly formed anchor-plates.

Ankyroderma jeffreysii, Danielssen and Koren, 1879 and 1882.

Deposits of three kinds—groups of five to six spoon-like rods arranged so as to form a star, with the enlarged perforated ends forming the centre of the star and supporting an anchor with a very long shank or handle and slightly serrated flukes; tables with the irregular perforated disk more elongate at the extremities of the body, and with a spire, three-armed at the base, terminating in a few spines; finally numerous small round or elliptical wine-red bodies of a concentric structure.

Habitat.—Northern coast of Norway and the Arctic Sea, north of Norway; depth varying from 127 to 459 fathoms (Danielssen and Koren), Barents Sea (Hoffman).

Ankyroderma affine, Danielssen and Koren, 1879 and 1882.

Deposits of four kinds—stars with anchors, like those in the preceding species, but more numerous and arranged in nearly regular rows; tables like those in the preceding species, but much more irregular; spicules consisting of several (five to eight) slender arms radiating from a common centre, which carries an outwardly directed process or spire; finally, very rare, minute wine-red bodies.

Habitat.—Arctic Sea, between Norway and Beeren Island, at a depth of 191 fathoms (Danielssen and Koren).

The fifth kind of deposits, viz., the conglomerates of calcareous grains and prisms, may probably be the result of artificial processes.

Ankyroderma roretzii (*Haplodactyla*), von Marenzeller, 1878 and 1881.

Deposits of four kinds—stars like those in the preceding species, but no anchors are observed; perforated, more or less irregular, round cups, each with a very long process, which either is solid and simple, or provided with holes, and as it were composed of three rods; a layer of brown, round or elliptic bodies of concentric structure; these brown bodies are wanting at the tail, where they are supplied with crowded tables consisting of a fusiform or rounded perforated disk, and a tripartite spire terminating in several spines.

Habitat.—Japan (von Marenzeller).

Though no anchors have been observed, such deposits may, nevertheless, be found, and I cannot avoid thinking that the "cups" with the long process, according to von Marenzeller always broken off, represent simply the basal parts of the anchors. My own researches into the Challenger material seem to confirm this supposition. I cannot fully understand the descriptions of Danielssen and Koren, according to which that part of the anchor-stocks, which is in communication with the star-like deposits, is "furnished with linear apophyses, five to six in number, according as the stellate figure consists of five or six calcareous rods." This species is very nearly related to *Ankyroderma jeffreysii* and may possibly be only a variety of it.

Genus 2. Eupyrgus, Lütken, 1857.

Retractor muscles absent. Calcareous ring without posterior prolongations. Tentacles fifteen, simple, unbranched. Body-wall very rough. Deposits—crowded tables consisting of a large irregularly rounded or triangular disk with undulated margin, and perforated with numerous, twenty or more, round holes; the spire is long conical, built up of three rods, running together so as to form a conical finely spinous top, and several (not exceeding four) transverse beams.

Eupyrgus scaber, Lütken, 1857; Semper, 1868. *Echinosoma hispidum*, Semper, 1868.

Habitat.—Arctic Sea, north of Norway (Danielssen and Koren), Nova Zembla and Kara Sea (Stuxberg), Barents Sea (D'Urban), Spitzbergen (Ljungman, Danielssen and Koren), Greenland (Lütken, Ludwig, &c.).

(Mus. Holm.) A great number of individuals from Greenland and Spitzbergen. Some of the radial pieces of the calcareous ring seem to have a very indistinct and ground bifurcation posteriorly.

Genus 3. Haplodactyla, Grube, 1840.

Retractor muscles absent or rudimentary. Calcareous ring with five bipartite posterior prolongations. Tentacles fifteen to sixteen, simple unbranched. Body-wall not rough. Deposits of simple structure, never in the shape of tables.

Haplodactyla molpadioides, Semper, 1868.

Body-wall thick, not transparent. Deposits—numerous small, irregular button-like bodies; and roundish thick bodies strongly furrowed round the periphery and with some minute central holes. Five small branched papillæ round the anus.

Habitat.—Bohol and Zebu (the main form), Bohol (var. *pellucida*), China (var. *sinensis*), and Singapore (var. *jagorii*) (Semper).

As is seen above, the following varieties are referred by Semper to this species:—var. *pellucida* and *jagorii*, both devoid of deposits in the perisoma, and var. *sinensis*. All these varieties, however, are not well known.

Haplodactyla australis, Semper, 1868. *Haplodactyla holothurioides*, Selenka, 1868.

Body-wall not transparent. Deposits—small flat elongated bodies or grains, with the ends slightly enlarged. Anal papillæ absent (?).

Habitat.—Waigou (Selenka), Timor and Padang (Ludwig).

Haplodactyla hyaloeides, Sluiter, 1880.

Body-wall thin transparent. Deposits only present in the five short anal-papillæ and their vicinity, where they have the aspect of branched spicules.

Habitat.—Batavia (Sluiter), Amoy (Ludwig).

Sluiter speaks of retractors, but these are probably very rudimentary, and, as usual in forms with no retractors or only minute ones, uniting only the calcareous ring with the most anterior portion of the longitudinal muscular bands; Sluiter himself could not observe their attachment to the longitudinal muscular bands.

The following three forms are unsatisfactorily known and need re-examination:—

Haplodactyla holothurioides (*Molpadia*), Cuvier, 1817; Semper, 1868.

Deposits absent in the body-wall.

Habitat.—Atlantic Ocean (Semper).

Haplodactyla mediterranea, Grube, 1840; Semper, 1868; Ludwig, 1879.

Habitat.—Mediterranean Sea (Grube).

Haplodactyla musculus (*Molpadia*), Risso, 1826; Semper, 1868; Ludwig, 1879.

Habitat.—Mediterranean Sea (Risso).

Genus 4. Trochostoma, Danielssen and Koren, 1877, 1882.

Retractors absent or rudimentary. Calcareous ring with five bipartite, posterior prolongations. Tentacles fifteen, branched, digitate. Anus often with teeth-like papillæ. Body-wall mostly rough. Deposits—ellipses of a reddish colour and concentric structure alone; or tables alone; or both kinds together.

A. Deposits—Ellipses and Tables.

Trochostoma boreale (*Molpadia*), Sars, 1859, 1861; Danielssen and Koren, 1882. *Molpadia oolitica*, Selenka, 1867 (*partim*). *Haplodactyla oolitica*, Semper, 1868 (*partim*).

Tentacles with three (?) digits. Deposits—small red, crowded ellipses; tables composed of an irregular network of a triangular or rounded form representing the disk with large holes and carrying a spire terminating in two slightly spinous tops; tables having the disk elongate fusiform with some central holes, and a spire terminating in a single slightly spinous top, these being present in greater number at the ends of the animal.

Habitat.—Finmark (Sars), Barents Sea (Hoffman), Kara Sea (Stuxberg), Florida Reef (Pourtalès).

(Mus. Holm.) Numerous specimens from the Arctic coast of Siberia. As it seems to me, each short tentacle has a very short, broad, middle digit, and a narrower on each side, thus three digits. Anus with five (?) short papillæ. The red bodies in the perisome seem mostly to be collected in groups.

Trochostoma thomsoni, Danielssen and Koren, 1878, 1882.

Several localities south and north of the Arctic circle in the North Atlantic Ocean, at depths from 136 to 658 fathoms (Danielssen and Koren).

So far as I can discover, this form must be very nearly allied to the former, and it seems to me almost impossible to point out any difference of such importance as to justify their separation into two distinct species. I do not think the very inconsiderable differences in the conformation of the deposits, &c., sufficient to establish a new species.

Trochostoma violaceum (*Molpadia*), Studer, 1877. *Trochostoma boreale*, Danielssen and Koren, 1879, 1882 (*partim*).

Tentacles with three short digits. Deposits—round or elongate reddish bodies of a concentric structure; very large, smooth fusiform rods or three-armed bodies without spire, but with a few holes at their middle; and small, very few scattered

tables composed of an irregular two- or three-armed network representing the disk and carrying a central slightly spinous process.

Habitat.—Kerguelen Island (Studer).

The species mainly differs from the preceding ones in the very large, fusiform or three-armed deposits without spires, present all over the body though in larger numbers at its extremities.

Trochostoma turgidum (*Molpadia*), Verrill, 1879.

Tentacles two-lobed. Deposits—round or oval orange-brown bodies of a concentric structure; large irregular table-shaped plates consisting of a perforated disk with a central circle of three to six holes and an outer of ten or more larger oval holes, and a central spire built up of three to four columns.

Habitat.—Southern coast of New England, Fundy Bay, Massachusetts Bay, Gulf of Maine, Casco Bay; off Nova Scotia, Gulf of St. Lawrence (Verrill).

Verrill does not mention anything about anal papillæ. From the description it is impossible to understand what is the meaning of "with two-lobed tentacles," either there really are only two digits or the two lobes are situated below the top of the tentacles, in which case the tentacles are three-lobed as in the preceding species. Possibly the species is identical with *Trochostoma boreale*, Sars, which is distinguished mainly by its tables being much more irregular and smaller.

B. Deposits—tables alone.

Trochostoma arcticum (*Haplodactyla*), von Marenzeller, 1878; Danielssen and Koren, 1879, 1882.

Tentacles with five to seven digits; in young only three digits. Tables almost like those in *Trochostoma boreale*.

Habitat.—Finmark (Danielssen and Koren), north of Nova Zembla (von Marenzeller). (Mus. Holm.) One specimen from the Kara Sea. The tables consist of a very irregular disk and a short spire. The disk consists of longer or shorter, branched or simple arms, running out irregularly from a common centre; these arms are either united with each other so as to form a disk with a few large holes, or they remain free, thus constituting a disk resembling a branched spicule. The spire consists of a simple shorter central rod, which often terminates in a few spines. Towards the extremities of the body the tables change their shape, their disk being elongate, more like true disks, and provided with more holes, and their spire being composed of about three rods intimately united with each other, so that the spire often gives the impression of being a simple column; the top of the spire terminates in several teeth.

C. Deposits—reddish-brown, concentric bodies alone.

Trochostoma ooliticum (*Chirodota*), Pourtalès, 1851; Danielssen and Koren, 1878, 1882. *Holothuria pentactes*, Gould, 1841 (according to Pourtalès). *Molpadia oolitica*, Selenka, 1867 (*partim*). *Haplodactyla oolitica*, Semper, 1868 (*partim*).

Habitat.—Massachusetts at Boston (Gould, Pourtalès, Selenka), Block Island south of Cape Cod, and Boon Island (Verrill).

Neither in the papers of Danielssen and Koren and Sars, nor in those published by Pourtalès, have I found any direct statement of the conformation of the tentacles in *Trochostoma boreale* and *Trochostoma ooliticum;* but Danielssen and Koren, who referred these species to *Trochostoma*, distinguish the named genus from *Haplodactyla*, by its having digitate tentacles and the integument mostly rough. For my own part I do not believe these characters to be of much importance, and the more so as several species of *Trochostoma* have very rudimentary digits, evidently forming a transition to *Haplodactyla* with its simple tentacles, and, besides, two species of *Trochostoma* have the skin smooth. Further investigations may prove whether the specific characters above cited be true, or only of varietal significance, or due to difference of ages or sex.

D. Deposits in the perisoma, absent.

Trochostoma arenicola (*Liosoma*), Stimpson, 1857.

Habitat.—San Pedro in California (Stimpson).

Each of the fifteen tentacles "is composed of a short peduncle with four or five digitations at the disk-like summit." With regard to the deposits, Stimpson says: "The genus differs from *Chirodota* in the want of the calcareous deposits in the skin so characteristic of the later form." Numerous specimens of a *Trochostoma* are preserved in the State Museum of Stockholm, dredged at the same locality in California, which, in external appearance, are almost like the preceding northern species, and doubtless are just the same forms as that examined by Stimpson. They are of about the same body-form as, for instance, *Trochostoma boreale* and *Trochostoma arcticum*, &c., but possibly more swollen at the middle of the body. They resemble the above named species in internal and external organisation, but seem to be totally devoid of deposits in the perisome. The tentacles are completely retracted in all specimens, consequently it is not possible to state their true appearance, but they evidently bear some short digits. Integument thick, smooth, leathery. Calcareous ring with five bifurcate prolongations posteriorly. The retractors absent, but traces of such present where the longitudinal muscular bands join the calcareous ring.

Genus 5. Caudina, Stimpson, 1853, von Marenzeller, 1881.

Retractor muscles absent. Calcareous ring with five bipartite posterior prolongations. Tentacles twelve to fifteen, digitate (or terminating in a disk ?). Caudal portion very long and narrow. Deposits—circular perforated disks or cups.

Caudina arenata (*Chirodota*), Gould, 1841; Pourtalès, 1851; Stimpson, 1853; Ayres, 1854; Selenka, 1867; Semper, 1868; von Marenzeller, 1881; Kingsley, 1881.

Tentacles fifteen, each with about four digits. Deposits—rounded circular disks with slightly undulating margin, and perforated with eight to twelve holes arranged round a central opening which often seems to be quadrifid.

Habitat.—Chelsea Beach near Boston (Gould, Pourtalès, Verrill, &c.), Massachusetts Bay (Verrill, Stimpson), Vineyard Sound to Chelsea (Verrill), Grand Manan (Ludwig, Selenka), Revere Beach, Mass. (Kingsley).

The accounts of the tentacles in this species are various, Gould only found eleven; Selenka and Ayres assert them to be twelve; Pourtalès has observed their number to be fifteen, each divided into five lobes; and, finally, von Marenzeller, who has had the opportunity of examining numerous specimens, states them to be fifteen, each with four digits, of which two at the top are minute.

Caudina ransonnetii, von Marenzeller, 1881; Ludwig, 1883.

Tentacles fifteen, like those in the preceding species. Deposits—regularly perforated very flat cups with outwardly, upwardly directed teeth in the margin; the opening of the cups is closed by an × -shaped figure with low-knobs in the centre and at the ends of the arms.

Habitat.—Yellow Sea (von Marenzeller), Japan (Ludwig).

Caudina coriacea (*Molpadia*), Hutton, 1872 and 1879. *Echinosoma* (*?*) *coriacea*, Hutton, 1879. *Caudina meridionalis*, Bell, 1883.

Habitat.—Wellington, New Zealand (Hutton, Bell).

The description of Hutton is too summary to communicate an idea of the animal in question. However, in the State Museum of Stockholm I have seen two specimens dredged at Wellington and presented by Hutton under the name of *Molpadia coriacea*. Hence I am able to state the correctness of the synonymy, and, though I could not examine the tentacles, I venture the suggestion that Hutton's species is identical with, or, at least, very nearly allied to, the above species of von Marenzeller. The absence of true retractors, the long tail, and, above all, the characteristic deposits, speaks for this close relation. However, there may exist some small differences in the shape of the calcareous ring, the bifurcate prolongations of the radial pieces being slightly longer and more slender in the

specimen from New Zealand. A re-examination and comparison of both forms is necessary. Even the deposits of the New Zealand form are not exactly like those figured by von Marenzeller, their margin bearing mostly roundish knobs instead of teeth; but I even found deposits with more conical teeth-like knobs in the same species.

Caudina caudata (*Microdactyla*), Sluiter, 1880; Ludwig 1883.

Tentacles twelve, terminating in a small disk. Deposits, resembling those in *Caudina ranzonnetii*, consisting of regularly perforated cups with teeth in the margin, and with the opening closed by an ×.

Habitat.—Sunda Strait (Sluiter).

Ludwig feels himself inclined to refer this species to *Caudina ranzonnetii*, but, if so, the description of Sluiter must be very incorrect. Indeed, the figures of the tentacles are very remarkable, and there seems to be but little doubt that they are incorrectly drawn and understood. On the other hand, his statement of the number of tentacles may probably be right, and the calcareous cups of the respective species differ from one another in an obvious manner. However, *Caudina caudata* may be ranged among the unsatisfactorily known forms.

Genus 6. Molpadia, Cuvier, 1817; Semper, 1868.

Retractor muscles present. Calcareous ring with five bipartite posterior prolongations. Tentacles twelve to fifteen, branched, digitate. Calcareous deposits—knobbed or spinous, perforated, roundish button-like disks.

Molpadia chilensis, J. Müller, 1850, 1854.

Tentacles twelve to fifteen, each with four digits. Deposits—very regularly formed, rounded buttons with symmetrically arranged rounded knobs and four central holes.

Habitat.—Chili (Müller).

Molpadia australis, Semper, 1868.

Tentacles fifteen, with four digits. Deposits irregularly formed, roundish buttons with asymmetrically placed (up to seven) holes, and with short spines in the margin as well as on their surfaces; besides, scattered calcareous rods in the deeper layer of the skin.

Habitat.—Rockhampton (Semper).

Genus 7. Embolus, Selenka, 1867.

Retractor muscles absent. Calcareous ring absent. Tentacles fifteen. Deposits—brownish-red ellipses of concentric structure.

Embolus pauper, Selenka, 1867 ; Pourtalès, 1869.

Habitat.—(?) Cape Palmas (Selenka).

The genus and species seem to be uncertain. Pourtalès says : " One of the specimens sent from the Cambridge Museum to Mr. Selenka had received by some accident the label of 'Cape Palmas (?)' and on this one he has based his new genus *Embolus*. I am perfectly satisfied that the *Embolus pauper*, Selenka, is the same thing as *Molpadia oolitica*. The figures he gives of the œsophageal ring of *Molpadia oolitica* and of a calcareous grain of *Embolus pauper* are both taken from specimens of *Molpadia oolitica*. The absence of the œsophageal ring in the specimen he examined is accidental, as is also the absence of the tail-like prolongation of the anal extremity of the body." Thus, this genus and species must probably be omitted.

In general, the distinguishing characters of the genera of this family are mostly of slight importance, and further investigation will probably result in a diminution in the number of genera as well as of species.

Order II. PEDATA.

Body of various shapes, provided with pedicels or papillæ, the latter often situated on the top of larger or smaller protuberances. Tentacles dendroid or peltate. Respiratory-trees present.

Family DENDROCHIROTÆ.

Subfamily STICHOPODA.

Genus *Cucumaria*, Blainville, 1834.

Cucumaria lævigata, Verrill, 1876 (Pl. III. fig. 5; Pl. VI. fig. 13).

Habitat.—Station 149B, Kerguelen Islands, January 17, 1874; lat. 49° 28′ S., long. 70° 30′ E.; off Royal Sound; depth, 25 fathoms; numerous individuals: January 29, 1874; off Christmas Harbour; depth, 120, 105, and 45 fathoms; numerous individuals. Station 151, February 7, 1874; lat. 52° 59′ 30″ S., long. 73° 33′ 30″ E., off Heard Island; depth, 75 fathoms; volcanic mud; a single specimen.

The specimens examined by me do not quite agree with the description given by Verrill, but, considering that the Challenger specimens were dredged in great numbers on the very same localities in which Verrill, Studer, and Smith state that *Pentactella lævigata* is "very common," there seems to be not the least doubt of their identity.

The body is fusiform, more or less elongated. The largest individuals, though contracted, have a length of as much as 115 mm. or more. The tentacles are almost without exception of equal size; only in a very few individuals are they unequal, some dorsal or ventral ones being smaller than the rest, and it is worthy of note that these smaller tentacles are not fixed in position, as is the case in the typical *Cucumariæ*. The anus is destitute of any teeth. The Polian vesicles are three to five, rather long, but in some individuals only one vesicle of considerable size is visible, while the others are very rudimentary. The retractor muscles issue from the longitudinal muscular bands near the middle of the body or nearer its posterior end. The genital tubes are simple. The pedicels of the bivium and trivium are almost equally large, and arranged in a double alternating row along each ambulacrum. No pedicels are found on the interambulacral spaces. In the smaller individuals the pedicels at the middle of the body are more scattered, so as to give the impression of being disposed in a single zigzag row.

According to Verrill, this species should be destitute of any calcareous ring, for

which reason he referred it to a new genus, *Pentactella*, but in this point I cannot agree with him. Among the specimens examined by me only the largest ones seem to want the calcareous ring; often it is very rudimentary, and never becomes visible without treatment with a solution of potash. In the smaller individuals it is more developed than in the larger. The five radial pieces of the ring (Pl. III. fig. 5, *a*) are more developed than the interradial, which mostly are very inconsiderable. As to its general appearance, the ring presents a certain resemblance to that in *Cucumaria crocea*, though in a much lower state of development.

With a few exceptions, all the individuals from Royal Sound and Betsy Cove are almost devoid of any calcareous deposits; this, however, seems to depend upon some impurity in the alcohol by which they have been dissolved. Thus, nearly all the larger specimens from these localities are totally devoid of deposits excepting in the pedicels. Only in a few forms of a more considerable size the deposits are left, but always in a more or less advanced state of solution, a fact from which I conclude that even the other individuals were provided with deposits, but that they have already been fully dissolved. The smaller forms, on the contrary, seem to resist the influence of an acid for a longer time, because most of them, kept in the same bottles, have their deposits left. At first I was almost tempted to think that I had to work with two different species, though living at the same localities, but having found some larger specimens with deposits in a state of dissolution, I cannot doubt that the smaller forms are only young of the larger. If, however, it should be proved that the largest specimens are destitute of deposits, it cannot cause surprise, considering the known fact that the larger forms of *Cucumaria frondosa*, for instance, are almost entirely devoid of deposits, while others are in possession of such.

The deposits (Pl. III. fig. 5 and Pl. VI. fig. 13) have the form of irregular plates which are rounded, oval, or more or less elongate. They are scattered, and perforated by four to twelve holes, of which the four central are larger, and their upper surface is provided with small knobs or spines. The largest plates have a length of about 0·18 mm. Besides these deposits, the integument contains small ×-shaped bodies, which, however, are only developmental stages of the former. The pedicels are strengthened by a well-developed terminal plate, and by some branched spicules and smaller plates resembling those in the body-wall itself. Even in the pedicels of the larger specimens, which are destitute of deposits in the perisome, such deposits are present. There is no doubt that *Cucumaria lævigata* bears the nearest resemblance to the northern form, *Cucumaria frondosa*.

Cucumaria crocea, Lesson, 1830 (Pl. XII. figs. 1, 2).

Habitat.—Station 313, January 20, 1876; lat. 52° 20′ S., long. 67° 39′ W.; depth, 55 fathoms; bottom temperature, 47°·8; sand; a few specimens. Station 314,

January 21, 1876; lat. 51° 35′ S., long. 65° 39′ W.; depth, 70 fathoms; bottom temperature, 46°·0; sand; one specimen. Station 315, January 26, 27, 28, 1876; lat. 51° 40′ S., long. 57° 50′ W.; depth, 5 to 12 fathoms; sand and gravel; very numerous specimens. Station 316, February 3, 1876; lat. 51° 32′ S., long. 58° 6′ W.; depth, 4 to 5 fathoms; mud; one specimen.

During his stay at the Falklands, Sir Wyville Thomson[1] paid special attention to this very interesting form, and it may be permitted to cite his own words:—"Adhering to the fronds of *Macrocystis* there were great numbers of an elegant little cucumber-shaped sea-slug (*Cladodactyla crocea*, Lesson), from 80 to 100 mm. in length by 30 mm. in width at the widest part, and of a bright saffron-yellow colour. The mouth and excretory opening are terminal; ten long, delicate, branched oval tentacles, more resembling in form and attitude those of *Ocnus* than those of the typical *Cucumariæ*, surround the mouth; the perisoma is thin and semitransparent, and the muscular bands, the radial vessels, and even the internal viscera can be plainly seen through it. The three anterior ambulacral vessels are approximated, and on these the tentacular feet are numerous and well developed, with a sucking-disk supported by a round cribriform calcareous plate, or more frequently by several wedge-shaped radiating plates arranged in the form of a rosette; and these three ambulacra form together, at all events in the female, a special ambulatory surface.

"The two ambulacral vessels of the 'bivium' are also approximated along the back, and thus the two interambulacral spaces on the sides of the animal, between the external trivial ambulacra and the ambulacra of the bivium, are considerably wider than the other three; consequently, in a transverse section, the ambulacral vessels do not correspond with the angles of a regular pentagon, but with those of an irregular figure in which three angles are approximated beneath and two above. In the female the tentacular feet of the dorsal (bivial) ambulacra are very short; they are provided with sucking-disks, but the calcareous supports of the suckers is very rudimentary, and the tubular processes are not apparently fitted for locomotion. In the males there is not so great a difference in character between the ambulacra of the trivium and those of the bivium; but the tentacles of the latter seem to be less fully developed in both sexes, and I have never happened to see an individual of either sex progressing upon, or adhering by, the water-feet of the dorsal canals.

"In a very large proportion of the females which I examined, young were closely packed in two continuous fringes, adhering to the water-feet of the dorsal ambulacra. The young were in all the later stages of growth, and of all sizes from 5 up to 40 mm. in length; but all the young attached to one female appeared to be nearly of the same age and size. Some of the mothers with older families had a most grotesque appearance, their bodies entirely hidden by the couple of rows, of a dozen or so each, of

[1] *Journ. Linn. Soc. Lond.*, vol. xiii. 1878, pp. 57–61.

yellow vesicles like ripe yellow plums ranged along their backs, each surmounted by its expanded crown of oval tentacles; in the figure the young are represented about half grown. All the young I examined were miniatures of their parents; the only marked difference was that in the young the ambulacra of the bivium were quite rudimentary—they were externally represented only by bands of a somewhat darker orange than the rest of the surface, and by lines of low papillæ in the young of larger growth; the radial vessels could be well seen through the transparent body-wall; the young attached themselves by the tentacular feet of the trivial ambulacra, which are early and fully developed.

"We were too late at the Falklands (January 23) to see the process of the attachment of the young in their nursery; even if we could have arranged to keep specimens alive under observation, there can be little doubt that, according to the analogy of the class, the eggs are impregnated either in the ovarial tube or immediately after their extrusion, that the first developmental stages are run through rapidly, and that the young are passed back from the ovarial opening, which is at the side of the mouth, along the dorsal ambulacra, and arranged in their places by the automatic action of the ambulacral tentacles themselves."

In order to complete the above description by Sir Wyville Thomson, the following remarks may be added:—As a rule, the tentacles in *Cucumaria* are unequal, two of the ventral ones being considerably smaller, but strangely enough, *Cucumaria crocea* appears to resemble the state in *Cucumaria frondosa*, &c., in having them equally large. The anus is devoid of teeth. Pedicels are only present in the ambulacra, where they are arranged in a double row along each. Sometimes this arrangement of the pedicels of the ventral ambulacra is slightly deranged, so that three instead of two rows are to be distinguished along each ambulacrum. The difference between the dorsal and ventral pedicels is very conspicuous, the former being more numerous and several times smaller. In the young, the size of the dorsal pedicels decreases gradually, so that in small individuals, from 20 mm. to 40 mm. long, no dorsal pedicels at all are to be seen. Besides, the smaller forms have only a simple row of pedicels on the ventral ambulacra, and it seems to be a rule that when the double rows of ventral pedicels are developed the dorsal ones begin to grow out.

The perisome is soft and very pliable, and does not contain any calcareous deposits, excepting in the tentacles and pedicels, the former being supported by scattered, small, perforated, irregular spicules or plates, the latter by a larger, well developed, round, perforated, terminal plate, with very numerous small holes, which is sometimes surrounded by small spicules. The calcareous terminal plates of the ventral pedicels are much larger than those of the dorsal pedicels, the former having a diameter of about 0·72 mm., the latter of only 0·38 mm. The Polian vesicle is single and rather large. The single, dorsal, madreporic canal winds upwards attached to the dorsal mesentery. In the largest specimens the retractor muscles are attached at a distance of about 25 mm. behind the

anterior extremity of the body, and in some individuals from Station 313 they communicate with the radial muscular bands at its middle. The calcareous ring is very narrow and fragile; when treated with a solution of potash it does not separate into distinct pieces, but seems to form a continuous whole. Anteriorly, it sends out ten comparatively long processes, of which the five radial are slightly enlarged at the tops and notched. The reproductive organs consist of two fascicles of long, slender, simple tubes, and its long efferent duct opens in a small papilla situated far behind the tentacles. Besides the two longer respiratory-trees, often one or two shorter ones are present.

The above description refers to the specimens dredged at Station 315. That obtained at Station 316 is totally devoid of any calcareous deposits, these having been probably dissolved by means of some impurity in the alcohol. The individuals, on the contrary, brought home from Stations 313 and 314 are remarkable for having the integument supported by some very scattered, irregular or almost round, perforated plates and more numerous larger and smaller spicules with the ends branched or perforated, resembling those found in the pedicels of the individuals from Station 315. The larger spicules measure as much as 0·22 mm. in length, the smaller about 0·08 mm., and the plates have a diameter of about 0·2 mm. or more. The plates as well as the rods are more or less spinous. In the individuals dredged at Station 313 the deposits are in a state of solution; which consideration renders it rather probable that the individuals from Station 315 have also been in possession of deposits in the body-wall, though they are dissolved. If this be so, I cannot conceive how it is possible that the terminal plates of the pedicels have been left. However, I have more than once observed that the calcareous ring as well as the deposits of the pedicels become dissolved later than the deposits of the body-wall itself.

Cucumaria crocea, Lesson, seems not to be identical with Semper's *Cucumaria godeffroyi*, but both forms are doubtless nearly allied to each other.

Cucumaria mirabilis, n. sp. (Pl. IX. fig. 5).

Body tapered towards each extremity, curved, with the convex ventral surface longer than the concave dorsum. Tentacles small, ten in number. Pedicels mainly belonging to the ambulacra, two or three rows in each, besides some scattered pedicels in the inter-ambulacra. Excepting these pedicels, some slightly larger elongate conical processes are to be found on the ventral ambulacra. Deposits—crowded tables consisting of an irregularly perforated rounded or angular disk with uneven margin and a short spire built up of only two short rods; the top of the spire terminates in several spines; pedicels and processes with transformed, rod-like tables. Colour in alcohol, light yellowish-grey. Length about 12 mm. (in contracted state).

Habitat.—Zebu (Philippine Islands); depth, 100 fathoms; one specimen. Port Jackson (Australia); depth, 6 to 15 fathoms; one specimen.

The body of the animal being in a state of contraction, it is almost impossible to decide whether the curve of the body is a result of an accidental contraction or not. For the same reason the arrangement of the ambulacral appendages is not easy to determine. So far as I can discover, the pedicels are situated mainly on the ambulacra, where they are disposed in two to three rows. But even in the interambulacra a few scattered pedicels may be observed, especially on the dorsal surface, though the middle line of the interambulacra always seems to be naked; consequently the narrow interambulacra give the impression of being in want of pedicels. Strangely enough, the three longer, ventral ambulacra carry at the middle of the body some conical elongate papillæ, which seem to be in want of sucking-disks. This is contrary to what was stated by Semper in *Cucumaria versicolor*, which species is furnished with papillæ scattered among the dorsal pedicels.

The calcareous ring (Pl. IX. fig. 5, *a*) is composed of ten pieces, of which the five radial are prolonged into two narrow processes posteriorly, which, if my observations be right, are composed of several joints. A single Polian vesicle and madreporic canal present. The ampullæ are visible on the inner side of the body-wall. The reproductive organs are composed of two thick bundles of short simple tubes.

The tables of the perisome (Pl. IX. fig. 5, *b*, *c*, *d*) are characterised by possessing a spire composed of only two rods and by the want of a larger central hole in the disk; besides, the spire is short, without transverse beam, and terminates in several teeth. The diameter of the disk is from 0·04 to 0·05 mm., the height of the spire is about 0·028 mm. The pedicels and papillæ are supported by transformed, curved, rod-like tables (Pl. IX. fig. 5, *e*, *f*). The walls of the body itself, pedicels and papillæ, are rough with the deposits.

The specimen brought home from Australia closely agrees with the above description. Length, 13 mm. Its body-form is more rounded, with the ventral surface longer and more convex than the dorsal surface. Tentacles fully extended, two ventral smaller than the rest. Pedicels arranged in a double row on each ambulacrum, and, besides, scattered on the interambulacra, which, however, are almost naked at the middle of the body and along their middle line. The pedicels have well-marked sucking-disks. At the middle of the body the three ventral ambulacra carry some long, slender, almost cylindrical papillæ, which are totally devoid of sucking-disks, but terminate in a conical top without terminal plates. These "papillæ" are about 4 mm. long, thus being much larger than the pedicels.

Cucumaria capensis, n. sp. (Pl. V. fig. 2).

Body cylindrical, indistinctly pentangular, more tapered posteriorly than anteriorly. Arms without teeth. Tentacles ten, two ventral considerably smaller. Pedicels in a

double row along each ambulacrum. The interambulacra naked. Integument rather hard, with numerous deposits—small irregular, slightly concave, cup-like, perforate bodies with spines on the concave and knobs on the convex surfaces; closely disposed buttons of various shape, the more regular with about four holes and a smaller number of larger knobs; and large, scattered, thick, almost scale-like, round, elongate or oval plates with numerous holes and knobs. Pedicels strengthened by transverse plate-like rods with holes and a few knobs. Terminal plates less developed. Colour in alcohol, light greyish. Length about 53 mm.

Habitat.—Station 141, December 17, 1873; lat. 34° 41′ S., long. 18° 36′ E.; depth, 98 fathoms; bottom temperature, 49°·5; green sand; a single specimen. Station 142, December 18, 1873; lat. 35° 4′ S., long. 18° 37′ E.; depth, 150 fathoms; bottom temperature, 47°·0; green sand; two specimens.

The calcareous ring (Pl. V. fig. 2, *e*) is slender, of common form, without posterior prolongations. A single Polian vesicle and madreporic canal are present. The slender retractors are attached at about the first fourth of the body. The reproductive organs are composed of simple unbranched tubes. The respiratory-trees are not very richly provided with branches. The integument is not very thick or hard, and contains a multitude of deposits; the larger deposits communicate to the surface of the skin a punctulate aspect.

The flat cups (Pl. V. fig. 2, *a*) are situated in the exterior layer of the perisoma, and present themselves under very variable aspects; sometimes they are simply cruciform, mostly, however, plate-like, with two to five holes. Their upper, concave surface is always provided with spines, while the inner surface carries some knobs. Their diameter measures as much as 0·04 mm. The buttons (Pl. V. fig. 2, *b*) even vary greatly as to their shape, some being oval symmetrical, others, on the contrary, very symmetrical, with a greater number of lobes and knobs. The smaller, symmetrical, true buttons measure as much as 0·1 mm. in length. The scale-like plates (Pl. V. fig. 2, *c*) are not closely crowded as in the former, but scattered, and attain a considerable size, up to 0·8 mm. in diameter. They are firmly constructed, thick, with numerous holes and knobs. A series of transitional forms between the buttons and plates are to be found. The pedicels carry numerous, knobbed or smooth, perforated plates, and, plate-like, more or less curved rods (Pl. V. fig. 2, *d*). The terminal plates seem not to be very well developed.

As far as I can find, this species cannot be referred to any other *Cucumaria* before known; it bears, indeed, some resemblance to *Cucumaria planci* and *Cucumaria syracusana*, but the former seems to be in want of the large plates, &c., and the latter carries pedicels even on the interambulacra, &c. It may even appear as if this species is very nearly allied to *Cucumaria discolor*, which has been brought home from nearly the same locality, but the latter is distinguished by the stellate mouth, the almost equally large tentacles, the rounded cylindrical body-form, the very thick, leathery perisoma, and by

the colour, &c. Nevertheless, further examination may prove that *Cucumaria capensis*, *Cucumaria discolor*, and *Cucumaria planci* represent different types of one and the same species.

Cucumaria discolor, n. sp. (Pl. IV. fig. 8).

Body subcylindrical, without any marked demarcation between the dorsal and ventral surfaces. Tentacles retracted, ten of almost equal size. Mouth stellate. Arms without teeth, and the anal portion not caudiform. Ambulacral appendages only on the ambulacra, completely retracted, more numerous on the ventral surface. The ventral pedicels larger, arranged in a double row along each ambulacrum. The dorsal appendages seem to be of a more conical form, present, when retracted, considerably smaller openings, and may possibly be considered as "papillæ;" they are evenly arranged in double rows. Integument thick, leathery, with the surface smooth without any visible scales. Deposits—slightly concave, very delicately constructed, perforated plates or cups with numerous spines or knobs; crowded buttons larger than the former, with a varying number of holes and large knobs; rounded, compact reticulate thick scales of varying but never of any considerable size. A complete series of transitional forms between the buttons and scales occurs. Colour in alcohol, light brownish-violet, with larger and smaller darkish brown spots. Length, 70 mm.

Habitat.—Simons Bay; depth, 10 to 20 fathoms; a single specimen.

Not having had the opportunity of examining the dorsal ambulacral appendages in an extended condition, I am somewhat uncertain whether they may be referred to papillæ or pedicels. If they were to be considered as true papillæ, the species might belong to the genus *Colochirus*, which contains forms (*Colochirus spinosus* and *Colochirus inornatus*) presenting an undoubted relation to it. The ventral pedicels as well as the dorsal are in communication with ampullæ depending into the peritoneal cavity, but those of the dorsal pedicels are smaller. A single Polian vesicle and madreporic canal are present. The retractors are attached at about the middle of the body. A small muscular stomach is present. The genital organs are composed of two thick bundles of simple, rather long tubes. The respiratory-trees are of common shape. The ventral pieces of the calcareous ring are inconsiderably smaller than the rest, and the undulated posterior margin of the ring is devoid of any processes.

The calcareous deposits closely resemble those found in the two above cited, nearly related species. The exterior layer of the perisome contains numerous small, slightly concave, very delicately constructed perforated plates or cups (Pl. IV. fig. 8, *a*), with the margin uneven, and with numerous long spines or knobs on their upper and inner surfaces; they measure as much as 0·06 mm. in diameter. The buttons which lie beneath the former commonly grow larger, up to 0·09 mm. or more, but it is no rarity to find much smaller ones provided with only four holes and a smaller number of knobs

(Pl. IV. fig. 8, *b*). The scales are commonly roundish, compact and thick, almost resembling a mulberry (Pl. IV. fig. 8, *c*), and do not attain a greater diameter than about 0·7 or 0·8 mm. A whole series of transitional forms are to be found between the small buttons and these scales, which have evidently been developed from the former. The pedicels and papillæ are strengthened by plate-like perforated rods (Pl. IV. fig. 8, *d*) and terminal plates, the latter being slightly larger in the pedicels.

Cucumaria mendax, n. sp. (Pl. V. fig. 3; Pl. XVI. fig. 3).

Body cylindrical or fusiform. Anus without teeth. Tentacles ten, of almost equal size. Pedicels pretty closely disposed, equally distributed all over the body, without traces of any arrangement in rows. Surface of the perisoma almost smooth. Deposits numerous, crowded, of two kinds—round or oval, rather symmetrical buttons with about four holes and ten large knobs, and elongated more or less irregularly formed knobbed plates with as many as ten holes, one end being slightly narrower and provided with spines. Pedicels supported by terminal plates and crowded perforated plates or rods, often with some spines on the margin and knobs on the surfaces. Colour in alcohol, yellowish-white. Length of the largest specimen, about 70 mm.

Habitat.—Station 315, January 26, 1876; lat. 51° 40′ S., long. 57° 50′ W.; depth, 5 to 12 fathoms; sand and gravel; six specimens.

In the largest specimen, brought home from the above mentioned Station, the arrangement of the pedicels completely resembles that characteristic of the genus *Thyone*, and, at first sight, I even referred it to this genus, but, considering the general organisation, it doubtlessly presents the nearest relation to several species of *Cucumaria* before known. In the five other smaller individuals, on the contrary, an arrangement of the pedicels in rows is perceptible, and especially in the smallest, about 25 mm. long, specimens this arrangement becomes most distinct. Thus, the outer aspect of these small specimens is very like that in Semper's *Cucumaria koellikeri* and *Cucumaria dubiosa*, and Ludwig's *Cucumaria salmini*, but they present even a great conformity in their internal organisation, as will be seen further on.

The calcareous ring is of the ordinary shape, without prolongations posteriorly, though traces of such are distinguishable in some of the radial pieces. The madreporic canal is single, dorsal. Four Polian vesicles are present. The retractors are attached at the middle of the body or slightly in front of it. The genital tubes are simple, unbranched, as much as 40 mm. long. The respiratory-trees in comparison to the genital organs are not very richly developed.

On comparing the descriptions of Semper and Ludwig, it will be found that the deposits of *Cucumaria mendax* almost completely resemble those in the three above-mentioned species. The knobbed and spinous plates (Pl. V. fig. 3, *a*) are situated

exteriorly, and measure as much as 0·15 mm. in length, while the buttons (Pl. V. fig. 3, *b*), on the contrary, have a more constantly regular form and a length of about 0·1 mm.

Probably, it will at once be stated that the species in question is identical with one of the before-mentioned species, these being younger forms, but for the present I think it better to hold them apart.

The small individuals mainly differ from *Cucumaria salmini* by the want of anal teeth, from *Cucumaria dubiosa* by the fact that the pedicels are present even in the ventral interambulacra, and from *Cucumaria koellikeri* by the number of Polian vesicles and by the simple genital tubes. *Cucumaria dubiosa* is possibly a young individual of *Cucumaria koellikeri*.

Cucumaria abyssorum, n. sp. (Pl. IV. fig. 6; Pl. XVI. fig. 6).

Body inflated, fusiform, with the posterior extremity tapered, caudiform. Tentacles ten, of almost equal size. Anus without teeth. Pedicels completely retractile, thinly distributed in a double alternating row along each ambulacrum. The spacious interambulacra naked. Integument thin and soft, supported by scattered, rather large four-armed calcareous bodies with the ends of the arms dilated, spinous and pierced by some holes; one of these arms especially is more developed, provided with more spines, and communicates to the surface of the body a certain degree of roughness. Pedicels strengthened by terminal plates and straight or slightly curved rods with the ends dilated, perforated and spinous, and with a larger or smaller spinous process in the middle; sometimes this process is larger and perforated. Colour in alcohol, yellowish-white. Length, 45 mm.

Habitat.—Station 147, December 30, 1873; lat. 46° 16′ S., long. 48° 27′ E.; depth, 1600 fathoms; bottom temperature, 34°·2; Diatom ooze; seven specimens. Station 156, February 26, 1874; lat. 62° 26′ S., long. 95° 44′ E.; depth, 1975 fathoms; Diatom ooze; three specimens.

The largest individual is remarkable in possessing only nine tentacles, but this can only be an abnormality. A single Polian vesicle and madreporic canal are present. The calcareous ring (Pl. IV. fig. 6, *a*) is not very well developed, and has no posterior prolongations. The retractors communicate with the muscular bands nearer the anterior end than the middle of the body. Anteriorly, the alimentary canal is provided with a very powerful, expanded, muscular stomach. The reproductive organs consist of short simple tubes arranged in a bundle on each side of the dorsal mesentery. The respiratory-trees have comparatively few and short branches, scattered all over their length.

The perisome is soft and pliable; its calcareous deposits (Pl. IV. fig. 6, *b*) are more thinly scattered. The diameter of the deposits measures 0·3 mm., and sometimes they bear some spines not only at the ends of the arms, but even in their middle.

It is characteristic of these deposits that one of the arms is always more developed and more richly furnished with spines and holes; and this arm is directed obliquely outwards. I do not know any species of *Cucumaria* provided with deposits like those in this abyssal form. The specimens obtained at Station 156 differ by the absence of deposits in the body-wall itself. These specimens, however, seem to be macerated and their deposits dissolved by some impurity in the alcohol. Possibly they are more nearly related to the variety *grandis*.

Cucumaria abyssorum, var. *grandis*, nov. (Pl. V. fig. 1).

Habitat:—Station 298, November 17, 1875; lat. 34° 7′ S., long. 73° 56′ W.; depth, 2225 fathoms; bottom temperature, 35°·6; blue mud; two specimens. Station 299, December 14, 1875; lat. 33° 31′ S., long. 74° 43′ W.; depth, 2160 fathoms; bottom temperature, 35°·2; blue mud; eight individuals. Station 295, November 5, 1875; lat. 38° 7′ S., long. 94° 4′ W.; depth, 1500 fathoms; bottom temperature, 35°·3; Globigerina ooze; a single specimen.

Considering the more highly developed state of the internal and external organs of these animals, it may possibly be most conformable to the truth to consider them as types of the species itself, but judging, on the contrary, from the deposits, they may properly be regarded as transitional forms, uniting the species with its variety, *hyalina*. They attain a considerable size, as much as 100 mm. or more, and differ mainly in the scarcity of deposits, which in most of the specimens seem to be confined only to the pedicels and tentacles. Only in one smaller individual, about 45 mm. long, scattered deposits are present in the body-wall itself, but they do not seem to attain a very high degree of development, excepting in the caudal portion of the body, where they are well developed. A closer examination will show that some of the deposits (Pl. V. fig. 1) resemble those known in *Cucumaria abyssorum*, but that others, especially those in the caudal portion, are of the same shape as those characteristic of *Cucumaria abyssorum*, var. *hyalina;* the more common forms, however, seem to be irregular × -shaped bodies with short ill-developed arms, and even simple rods with one end spinous and directed outwards. Even transitional forms between the rods and four-armed bodies are not rare. As a rule, it may be observed that the arms of the deposits are shorter and the deposits themselves more irregular than is the case in *Cucumaria abyssorum* and its variety *hyalina*. The deposits in the pedicels closely resemble those in the typical form itself. The rest of the individuals obtained from Station 299 are devoid of deposits in the body-wall; only in the neighbourhood of the pedicels and in the pedicels themselves have I found deposits of the same characteristic shape as those in the smaller specimen above described. It may be kept in mind that the larger individuals are devoid of deposits, while the smaller have such, a peculiarity which

seems to be common to several forms of the genus in question. The specimens dredged at Stations 295 and 298 are totally devoid of deposits, the calcareous substance having probably been dissolved.

The integument is thin, often transparent. The calcareous ring resembles that in *Cucumaria abyssorum*, but appears narrower. The Polian vesicle and madreporic canal are single. The muscular stomach is not very well developed. The reproductive organs as well as the respiratory-trees are more highly developed than in the species itself.

Cucumaria abyssorum, var. *hyalina*, nov. (Pl. IV. fig. 7).

Body subcylindrical or fusiform, slightly curved, more tapered posteriorly. Tentacles ten, of almost equal size. Anus surrounded by some small papillæ and more strongly developed, tooth-like deposits. Pedicels arranged in a double row along each ambulacrum, slightly more numerous on the ventral than on the dorsal surfaces. Integument thin, glassy, and very rough from scattered, rather large four-armed deposits, resembling those in *Cucumaria abyssorum*, but provided with a long, spinous, outwardly directed process. Pedicels strengthened by terminal plates and transverse supporting rods almost like those in the species just named. Colour, white, transparent. Length up to 30 mm.

Habitat.—Station 147, December 30, 1873; lat. 46° 16′ S., long. 48° 27′ E.; depth, 1600 fathoms; bottom temperature, 34°·2; Diatom ooze; three specimens. Station 300, December 17, 1875; lat. 33° 42′ S., long. 78° 18′ W.; depth, 1375 fathoms; bottom temperature, 35°·5; Globigerina ooze; two specimens.

Though this variety bears the closest resemblance to *Cucumaria abyssorum*, it is easily distinguished by several obvious characters. The posterior extremity of the body is not so evidently tail-like. The pedicels are more numerous and the integument is transparent glassy, and much rougher with the outwardly directed processes of the deposits visible to the naked eye. The characteristic four-armed deposits (Pl. IV. fig. 7) are scattered and distinct from those in the above named species by the presence of a rather large and spinous, outwardly directed process, running out from the base of one of the arms or from the central part of the deposits itself. Often that arm, which carries the spinous process, is shorter than the rest. The ends of the arms are commonly pierced by one to four holes, seldom by more. In less developed deposits the ends of the arms are completely devoid of holes, simple or provided with some minute branches. The diameter of the deposits measures as much as 0·1 mm. It may, however, be remarked that even in *Cucumaria abyssorum* the deposits show a tendency to develop such outwardly directed spines. The pedicels are supported by terminal plates and transverse supporting rods almost like those in the above cited species. From scanty materials I cannot give any detailed description of the papillæ and

"teeth" round the anus; the former resemble small undeveloped pedicels, the latter have the shape of rather large perforated plates with the margin very uneven, spinous. Commonly the deposits in the anal portion of the body are more crowded.

Only a single madreporic canal and Polian vesicle are present. The calcareous ring seems to be of about the same conformation as that in *Cucumaria abyssorum*, though in a lower state of development. The retractors are very short, only 4 or 5 mm. long. A well-developed muscular stomach is present. The genital tubes are short, simple, and collected into two bundles, one at each side of the mesentery. The respiratory-trees have short, scattered branches, all over their length.

The two specimens brought home from Station 300 are slightly larger, about 40 mm. long; and the surface of their perisome is very rough, almost spinous, from the large outwardly directed spinous processes which are visible to the naked eye.

Cucumaria kerguelensis, n. sp. (Pl. XII. figs. 6, 7).

Body fusiform, more tapered posteriorly. Tentacles ten, two ventral considerably smaller. Anus with minute teeth. Dorsal surface with pedicels distributed without order all over its ambulacra and three interambulacra; only anteriorly and posteriorly an arrangement in rows is discernible. Ventral surface with close-lying pedicels arranged in a double row along each ambulacrum; its interambulacra are well marked, naked, excepting anteriorly and posteriorly, where some small pedicels are present, making the arrangement in rows there less distinct. The outer or rather upper series of the two lateral double rows of pedicels is, however, not very well marked out. Deposits—scattered minute ×-shaped bodies; and crowded, irregular, angular, rounded, oval or elongate, perforated plates, with uneven margin, numerous holes and more and less prominent knobs. The most highly developed plates almost resemble scales with their upper surface convex and knobbed. A whole series of developmental stages from simple ×-shaped deposits are to be found. Colour in alcohol, light yellowish-grey. Length, 75 mm.

Habitat.—Station 149B, January 17, 1874; lat. 49° 28′ S., long. 70° 30′ E.; off Royal Sound; depth, 25 fathoms; volcanic mud; six specimens.

The body seems often to be slightly curved, with the anus bent upwards and the dorsal surface shorter than the ventral. In the foremost part of the body the pedicels are collected in five groups, consequently a tendency to an arrangement in rows of the dorsal pedicels is here traceable. Even posteriorly it is not difficult to distinguish the five rows. But for the rest, the pedicels are equally scattered over the dorsal surface. All the pedicels do not appear to be of equal size, some being considerably smaller.

The calcareous ring is small, of the ordinary shape, and its posterior margin is undulated without processes; the radial pieces are notched anteriorly and have about the same height as the interradial, 2 mm. A single Polian vesicle and madreporic canal are present.

The retractor muscles are attached at about the middle of the body. The two bundles of the genital organs are composed of simple unbranched tubes. The respiratory trees are not very richly provided with branches.

The integument is thin, pliable, and smooth. The minute ×-shaped bodies are very scattered, and situated in the exterior layer of the perisoma; their arms are curved, directed outwards, and sometimes even bipartite at their ends. They measure as much as 0·06 mm. in diameter. The plates are closely disposed, and vary greatly in form and size. Thus, one may find a complete series of developmental stages from ×-shaped bodies with the arms simple or dichotomously branched, and small irregular plates with a few holes, up to large round oval or angular, thick, convex, scale-like plates with numerous holes and knobs. These larger plates are composed of several layers, with the upper surface convex, almost acquiring an aspect like that of the scales of a *Colochirus*. The largest plates measure as much as 0·6 mm. or more. In the ventral perisome, especially near the middle row of pedicels, the plates often seem to be elongate, narrow, with two or three longitudinal rows of holes. The pedicels are supported by numerous crowded irregular transverse rods or rod-like plates, with a few perforations, and their terminal plates are not very well developed. *Cucumaria parva* is doubtless very nearly related to this species, and having found nothing contrary in the description of Ludwig, excepting the largeness of the individuals and the anal armature, I was almost inclined to consider them to be identical.

Cucumaria insolens, n. sp. (Pl. IV. fig. 5).

Body subcylindrical, with the anal portion often slightly curved upwards. Tentacles ten, of almost equal size. Pedicels of two kinds: larger, completely retractile ones arranged in double rows along the three ventral ambulacra, and even distributed on or near the dorsal ambulacra; and considerably smaller (papillæ ?) present all over the dorsal surface as well as in the anterior and posterior parts of the ventral surface. The integument is thick and hard from the presence of three kinds of deposits arranged in several superposed layers. The exterior part of the integument is furnished with numerous small cruciform bodies with the arms curved and more or less branched (incomplete cups); beneath these there is a rich layer of large, elongate or oval, thick, knobbed, and perforated buttons with one end drawn out into a narrow spinous portion, which is directed obliquely outwards; interiorly densely crowded, small, rounded, more regular buttons with few holes and knobs are to be found. The pedicels, the larger as well as the smaller, are strengthened by terminal plates and strong, irregular, branched or unbranched slightly perforated rods. Colour in alcohol yellowish-grey, often darker and brownish on the back. Length up to 40 mm.

Habitat.—Simons Bay; depth, 10 to 20 fathoms; numerous individuals.

This form of *Cucumaria* is very remarkable, and seems to present a certain relation

to the genus *Colochirus*, as may be seen from the following description in which the differences are referred to. The oval aperture, when closed, does not present the five prominences characteristic of the genus just named, and the anus, though often slightly turned upwards, is devoid of teeth. The three double rows of ventral pedicels are very distinct, but no marked sole is obvious. Posteriorly, these rows decrease and become almost invisible in the anal portion, which is to be clearly observed in the few specimens which have this portion extended. Even the dorsal ambulacra are provided with pedicels of about the same size and appearance, but they seem to be more scattered and arranged in double rows which are not very distinct; when fully retracted, it is almost impossible to distinguish them from the surrounding smaller pedicels. Only in a very few specimens were they sufficiently extended to allow their position to be determined. Anteriorly, immediately behind the crown of tentacles, one may always clearly observe some pairs of pedicels in connection with each of the five ambulacra. The other kind of pedicel is much smaller, and ought probably to be referred to those ambulacral appendages which are called "papillæ"; they are scattered all over the dorsal surface, and even over the anterior and posterior portions of the ventral surface between the series of larger pedicels. I never saw them extended. Considering the presence of pedicels and papillæ and their arrangement, the resemblance of this species to *Colochirus inornatus* is obvious, though it may be distinguished from it by the dorsal rows of true pedicels. On the other hand it is undoubtedly nearly allied to Semper's *Cucumaria versicolor*.

The calcareous ring (Pl. IV. fig. 5, *a*) is of the usual form, composed of ten simple pieces, without processes posteriorly. A single Polian vesicle and madreporic canal are present. The reproductive organs are composed of numerous narrow, unbranched tubes, and their efferent duct is long and slender. The ampullæ of the pedicels and papillæ are visible from the interior. The retractors are attached at about the middle of the body.

The cruciform bodies (Pl. IV. fig. 5, *f*), which are present in the exterior layer of the perisoma, lie closely though not crowded, and their curved, simple, or more or less dichotomously branched arms are directed outwards; they have a diameter of about 0·05 mm. Beneath these deposits a layer of rather large oval, elongate or rounded, knobbed and perforated buttons are to be found; they have one end rounded, the other on the contrary narrowed, prolonged, and spinous (Pl. IV. figs. 5, *b* and 5, *c*). The prolonged spinous end is always directed outwards, and in the very contracted specimens I examined, the buttons were often standing on their edges and had a fusiform appearance. They reach a length of 0·3 mm. The third kind of deposit (Pl. IV. fig. 5, *d*) consists of small rounded buttons, forming a rich layer beneath the former; they have only a few holes and knobs, and their diameter is about 0·1 mm. A whole series of transitional forms (Pl. IV. fig. 5, *e*), combining the two extremes of buttons, seem to be present.

The larger as well as the smaller pedicels are strengthened by terminal plates, and

strongly constructed, curved or straight, branched or unbranched perforated rods (Pl. IV. fig. 5, *g*). The terminal plates of the larger pedicels are mostly of greater circumference, though commonly not very well developed.

Cucumaria multipes, n. sp. (Pl. IV. fig. 4).

Body cylindrical, without any elevations or processes. Pedicels very crowded, disposed in a double row along each ambulacrum, rather long and probably not retractile. Tentacles, calcareous ring and inner organs unknown. Deposits—numerous densely crowded tables with irregularly rounded or mostly elongate, fusiform disks supporting an irregular spire which usually seems to be composed of four rods. The pedicels supported by terminal plates and closely packed transverse tables with the disks narrow and rod-like. Colour in alcohol, light grey.

Habitat.—Yokohama; depth, 8 to 10 fathoms; only a fragmentary specimen. From the scanty materials the description cannot be but very incomplete. When looking at the exterior of the body, one is almost tempted to believe the pedicels to be disposed in more than two rows on each ambulacrum, but examining the body-wall from the interior, it becomes evident that only two rows of pedicels are present. The pedicels are very closely placed, and do not seem to be retractile. Among those species of *Cucumaria* which are characterised by double rows of locomotive organs, there is only one form, so far as I know, furnished with tables alone in the perisome, *Cucumaria populifera*, Stimpson; but to judge from the descriptions of these forms, the calcareous deposits may have a form different from that of the species here described.

The deposits present only a single form, viz., tables (Pl. IV. fig. 4) which are very closely disposed. Their disks are sometimes irregularly rounded or multangular, but by far their most common form is oval or elongate, fusiform, with one or both ends slightly drawn out; they are completely smooth, penetrated by a varying number of holes, and measure 0·32 mm. in length. The spire is not very regularly formed, and from its state of solution it is difficult to get an exact idea of its appearance. It reaches a considerable length, 0·1 mm., and is composed of from two to four rods, united by several transverse beams and terminating in some irregular spines or teeth. In most cases it is impossible to distinguish the rods, but the spire seems to be perforated by a few longitudinal series of holes, and terminates in several curved or branched tops. The smaller disks support a spire of about the same size, or larger than that in the larger tables. In some of the larger elongate tables the spire is reduced to a central bridge, sometimes with a central hole.

Even the pedicels are strengthened by very numerous tables, but here the disks are much narrower, rod-like, transverse in position, with fewer holes, of which four or more are situated in the slightly dilated middle of the disks; their spire is more irregular.

Besides tables, terminal plates are to be found. This species is doubtless allied to *Cucumaria longipeda* described by Semper and von Marenzeller, but it is in want of any pedicels in the ventral interambulacra.

Cucumaria serrata, n. sp. (Pl. IV. fig. 1).

Body elongate fusiform, more tapered posteriorly than anteriorly. Tentacles of almost equal or of unequal size. Pedicels arranged in a simple row along each ambulacrum, excepting anteriorly behind the tentacles, where two rows instead of one are visible. No ambulacral papillæ or processes present. The interambulacra naked. Calcareous ring in a lower state of development. Madreporic canal single. Two Polian vesicles. Calcareous deposits —very crowded, closely disposed knobbed and perforated plates with one end drawn out into a long, straight, or slightly curved, spinous, and perforated process. Surface of the integument rough, on account of the oblique outward direction of the spinous processes of the plates. Colour in alcohol, light greyish. Length about 35 or 40 mm.

Habitat.—Station 150, February 2, 1874; lat. 52° 4′ S., long. 71° 22′ E.; depth, 150 fathoms; bottom temperature, 35°·2; coarse gravel; several specimens.

In some individuals all the tentacles are equal, but they are not so always. Thus, I have seen a specimen with six tentacles much smaller than the remaining four, and in another individual two tentacles were slightly larger than the rest, &c. The pedicels of each ambulacrum are not crowded, but arranged in a simple zigzag row at some distance from one another; only anteriorly is a double row to be observed. The pedicels do not seem to be completely retractile. The perisome is very hard, though not thick, from the very numerous densely crowded and partly overlapping plates which fill it up. Behind the tentacles, however, it has but few deposits. The plates (Pl. IV. fig. 1) are of a very characteristic form, somewhat resembling those in Semper's *Cucumaria leonina* and Brandt's *Cucumaria miniata*. They are more or less elongate, and directed obliquely outwards, so that the inner end is rounded or obtuse, broad and more closely fenestrated; the holes decrease in number towards the other, narrow, highly prolonged handle-like end, which terminates in some spines giving to the surface of the animal a high degree of roughness. Moreover, the plates are provided with larger and smaller knobs, and their margin is uneven. The handles of the plates are often more or less obviously curved. Their length is about 0·27 mm. The pedicels are strengthened by terminal plates and numerous other deposits partly of the same shape as those in the body-wall itself, though more or less deformed, partly resembling simple perforated irregular smooth plates; no supporting rods are present. The tentacles have rather large perforated, smooth plates (Pl. IV. fig. 1*b*), as well as numerous smaller, curved, fenestrated ones; even here no rods are to be detected.

The calcareous ring is very rudimentary, and does not appear to the naked eye unless

by treatment with a solution of potash. It consists of five very small fragile radial pieces, held together by some very minute interradial fragments; each radial piece is deeply notched. Only a single madreporic canal, but two cylindrical, narrow Polian vesicles, about 20 mm. long, are present. The alimentary canal presents anteriorly a kind of muscular stomach with strong muscular walls. The retractors are attached at about the middle of the body or a little more posteriorly. The genital tubes are simple, and the efferent duct very long. The respiratory-trees are slender and very little ramified. Considering the great resemblances, I am much inclined to consider this species to be identical with Semper's *Cucumaria leonina*.

Cucumaria serrata, var. *intermedia*, nov. (Pl. III. fig. 6; Pl. IV. fig. 2).

Habitat.—Station 150, February 2, 1874; lat. 52° 4′ S., long. 71° 22′ E.; depth, 150 fathoms; bottom temperature, 35°·2; coarse gravel; several specimens. Station 151, February 7, 1874; lat. 52° 59′ 30″, long. 73° 33′ 30″ E.; off Heard Island; depth, 75 fathoms; volcanic mud; several specimens.

So far as I can find, the only difference existing between the typical form and its variety is seen in the deposits, which are much larger in the former, and have the handle much longer and narrower. In the variety, the deposits only attain a length of 0·16 mm., and their handle is short, broad, and spinous. The plates themselves are oval, elongate, or sometimes almost round, and the number of holes and knobs is very variable. Moreover, some small ×-shaped bodies and rounded plates, with a few perforations, are to be observed in the integument of both forms, but these represent only different stages in the development of the plates. Anteriorly, the perisome is almost destitute of deposits. The pedicels and tentacles are strengthened by deposits of about the same shape as those in the true specific form; thus no rods are present, but only rather large, smooth, perforated plates of varying forms (Pl. IV. fig. 2*b*). Instead of two Polian vesicles, I often find four.

The specimens from Station 151 are considerably larger, some of them measuring 65 mm. or more, and they differ from the former mainly by the presence of a greater number of pedicels, which in some specimens seem to form a double alternating row along each ambulacrum. The smaller individuals, on the contrary, like those from Station 150, have them arranged in simple zigzag rows, excepting, of course, anteriorly, where two rows are always present. But it is a well-known fact that the young forms always have fewer pedicels situated in a simple row, while the older forms possess double rows.

Cucumaria serrata, var. *marionensis*, nov. (Pl. IV. fig. 3).

Habitat.—Marion Islands, December 26, 1873; depth, 50 to 75 fathoms; numerous specimens. Station 148A, January 3, 1874; lat. 46° 53′ S., long. 51° 52′ E.; depth, 550 fathoms; hard ground, gravel and shells; a single small specimen.

No other differences between the present and the two former specimens are to be found, except the fact that the calcareous deposits are smaller, and have fewer holes, but they are often more closely knobbed; moreover, the handle is more minute. They measure 0·14 or 0·15 mm. in length. Among these deposits one may find smaller almost roundish knobbed plates with only a few (four or five) holes and no handle, or only a rudimentary one, recalling those in *Cucumaria lævigata*. In this respect it seems that the variety *intermedia* forms a transition between var. *marionensis* and the typical *cucumaria serrata*. One of the specimens dredged at Marion Islands measures about 55 mm.; that part of it which is fully extended has only a simple zigzag row of pedicels on each ambulacrum, while the more contracted parts of the body have the pedicels in double rows. The Polian vesicles and a single madreporic canal are present.

Genus *Ocnus*, Forbes, 1841.

Ocnus typicus, n. sp. (Pl. XIV. fig. 11; Pl. VI. fig. 10).

Body narrow, elongated, tapered towards each extremity. Pedicels in a simple row along each ambulacrum, rigid, not retractile. The interambulacra naked. The ventral ambulacra with about twenty, the dorsal with about fifteen pedicels. Deposits of three kinds—large, thick, rounded, or oval scales; small, irregular, knobbed buttons; and minute dichotomously branched bodies or rosettes. Length of the largest specimen about 40 mm.

Habitat.—Hong Kong, at a depth of 10 fathoms; two specimens.

The body of this typical *Ocnus* is very elongate, slightly more tapered posteriorly than anteriorly. In one specimen the body is rounded and fusiform, in the other pentangular. Both specimens are more or less strongly curved. No anal teeth are present. The tentacles are retracted. The pedicels are hard, directed straight out from the body, and seem not to be capable of retraction. They are distributed in five very distinct simple rows, arranged in straight lines only, as is common in several northern species. The perisome is very hard, leathery, and the scales do not imbricate, but are visible externally as rounded larger or smaller darker spots. The scales are round or ovate, thick in the middle, decreasing towards the margin; they are built up of a strong calcareous network, and the largest have a diameter of 0·8 mm. to 1 mm. The buttons (Pl. VI. fig. 10*a*), about 0·06 mm. in diameter, present themselves under very different forms, having very seldom a symmetrical appearance. They are mostly irregularly rounded or oval, with a few, four to six, perforations, and with the margin uneven from the often rather prominent knobs which are situated on it. One or two knobs are also to be found in the middle of the buttons. The rosettes (Pl. VI. fig. 10*b*) are very

minute, about 0·024 mm. in diameter, and irregularly formed. Towards the extremities of the pedicels the deposits are more asymmetrical and sometimes rod-like.

There is no doubt that this species is nearly allied to Semper's *Ocnus imbricatus*, and mainly differs from it by the possession of buttons, and by the fact that the scales do not imbricate. Both forms seem to be very typical representatives of the genus *Ocnus*, and are characterised by a hard, thick perisome containing scales, as well as other deposits, and by the arrangement of the pedicels in distinct simple rows.

Genus *Colochirus*, Troschel, 1846.

Colochirus spinosus (Quoy and Gaimard), 1833 (Pl. XIV. figs. 3, 4; Pl. VI. fig. 12).

Habitat.—Port Jackson (Australia); depth, 6 to 7 fathoms; fifteen to eighteen specimens.

The largest specimen attains a length of 80 mm. The body is oval or elongate, more tapered posteriorly than anteriorly. In most of the specimens the mouth, and especially the anus, are turned upwards, the body acquiring thus the appearance of an Acidian. The mouth is closed by five projections of the perisome, and the anus is surrounded by about five conical teeth, which in most cases are difficult to discover because they have their place within the anal aperture. The anal portion of the body is covered with imbricating scales, which decrease in size towards the aperture itself. Excepting a simple row of six to eight sharp, conical prominences along each side of the body, the surface of the animals is almost smooth, but presents numerous small pits from the completely retractile pedicels and "papillæ." The two ventral tentacles are much smaller than the remaining eight. A single madreporic canal and Polian vesicle are present. The ventral pieces of the calcareous ring are narrower than the rest.

The ambulacral appendages are very minute and retracted in all the specimens, so that it is almost impossible to decide whether two kinds are really present. They are scattered without order all over the body, but are a little more crowded on the ventral than on the dorsal surface; only along the odd ambulacrum is a double row of ambulacral appendages traceable. As far as I can find, the only difference existing between the dorsal and ventral appendages is that the latter possibly has the sucking-disk slightly larger, and the terminal plate very slightly more developed, but both of them are strengthened by supporting rods of about the same shape. Each of the conical prominences along the sides of the body is in possession of an ambulacral appendage.

The calcareous deposits have about the same appearance as those in *Colochirus inornatus*, to which the species in question bears the nearest resemblance. The rounded or oval reticulate thick scales never attain a greater size, the largest having a diameter of from 2 to 3 mm. The cups are knobbed (Pl. VI. fig. 12*a*), very

flat, and made up of a central ×-shaped rod with the arms connected so as to form a complete knobbed ring. In most cases a branched or unbranched rod, or an incomplete network covers the concave side of the cups. The cups are rounded or oval, with a diameter of about 0·08 mm. The buttons (Pl. VI. fig. 12*b*) are very solid, rounded or oval, with in most instances four holes and very large knobs; they are somewhat larger than the cups. A few buttons (Pl. VI. fig. 12*c*) are almost smooth without knobs. The supporting rods of the ambulacral appendages are usually perforated in each end and in the enlarged middle.

Colochirus inornatus, von Marenzeller, 1881 (Pl. VI. fig. 8).

Habitat.—Japan; depth, 8 to 50 fathoms; ten specimens.

All the specimens are highly contracted, with the tentacles retracted within the body, which presents a fusiform appearance. The mouth is closed by five valvular projections, and is in most of the individuals bent upwards. The perisome is rather hard and inflexible. The anal portion of the body is much more tapered and distinctly turned upwards. The anus is surrounded by five very minute teeth. The two ventral are much smaller than the eight remaining tentacles. All the ambulacral appendages, even the dorsal ones, are completely retractile, and distributed all over the body, whereby the surface of the latter acquires a punctated or finely pitted aspect. No dorsal processes or elevations of the body-wall, which are so characteristic of most of the representatives of the genus *Colochirus*, are visible. Only in one specimen does the dorsal surface show traces of some minute elevations.

The pedicels, which are marked out from the remaining minute ambulacral appendages or "papillæ" by a larger and more distinct sucking-disk, seem to be arranged in three longitudinal ventral series. Each series is broadest at its middle, and is there composed of about five pedicels in breadth, but it decreases towards the extremities, where the pedicels finally form a double row. Even the ventral narrow interambulacra are occupied by some scattered "papillæ" and pedicels, the three series being not quite distinctly marked. The "papillæ" are closely crowded all over the dorsal surface and over the anterior and posterior parts of the ventral surface, while they, on the contrary, are very thinly scattered on the middle of the ventral interambulacra.

The ventral surface is light, the dorsal, on the contrary, darker, with light spots at each papilla. A single madreporic canal and Polian vesicle are present. The three ventral pieces of the calcareous ring are considerably narrower than the rest. The ring is always devoid of any posterior processes. The retractor muscles are attached to the middle of the body.

The deposits present themselves under several different kinds. In the exterior layer of the perisome numerous irregular, reticulate, more or less complete, almost flat cups

(Pl. VI. fig. 8*a*) are to be found with the inner and outer surfaces knobbed or spinous. These cups are built up of an ×-shaped central rod, with the branched arms partly connected so as to form a knobbed or spinous continuous rim, partly free and devoid of any complete rim, a condition which seems to be the most usual. The diameter of the cups measures 0·10 mm. With the exception of these cups, one finds in the perisome small, regularly formed, thick, robust buttons (Pl. VI. fig. 8*b*) with large, rounded knobs and usually four holes, and, moreover, other numerous more or less regular or symmetrical buttons of a more delicate conformation, and provided with a greater number of holes and knobs. A whole series of transitional forms between the two extremes of buttons are to be seen. The scales do not reach any more considerable size. The pedicels are strengthened by rather large, robust and broad, crowded, rod-like plates, and also by terminal plates and buttons. Even the "papillæ" are supported by plates. On treating a piece of the integument with a solution of potash, one finds here and there larger and smaller almost smooth perforated plates, but these are probably derived from the pedicels or processes. Any more obvious imbrication of the scales in the anal portion of the body is not to be observed.

Colochirus violaceus, n. sp. (Pl. XIII. figs. 1, 2; Pl. V. fig. 4).

Body cucumiform, equally rounded anteriorly and posteriorly. Tentacles ten (?), only six being left. Pedicels arranged in three distinct series along the ventral surface, each series composed of four to five rows. The series decrease in breadth towards the extremities of the body, where the pedicels are represented by "papillæ." The whole dorsal surface is covered with small scattered conical papillæ, those on the ambulacra being slightly larger than those on the interambulacra, which are minute. Even the ventral surface carries minute papillæ on its interambulacra. The oral opening is surrounded by five groups of rather large conical papillæ, each group being composed of two or three papillæ united at their bases. The anus is surrounded by five very large and rough calcareous teeth. The perisome is thick, leathery, and remarkable on account of its scarcity in deposits, which consist of small, very irregular, smooth plates usually perforated by one to four, seldom more, holes; among these deposits, small rod-like or ×-shaped ones are to be found. Excepting terminal plates and a few perforated, transverse rods, no deposits occur in the pedicels. The papillæ are provided with a few perforated rods, and are entirely devoid of or possess only very small terminal plates; moreover, the larger papillæ seem to be strengthened by large irregularly reticulated plates composed of several layers. Colour in alcohol, light violet, here and there inclining to yellowish and bluish; the papillæ and anal teeth are lighter, the former mostly resembling white or yellowish spots. Length about 190 mm.

Habitat.—Station 203, October 31, 1874; lat. 11° 6′ N., long. 123° 9′ E.; depth, 20 fathoms; mud; a single specimen.

Though the animal in question differs greatly in several respects from the typical representatives of *Colochirus*, it cannot be referred to any other hitherto known genus. The pedicels are rather large, cylindrical and retractile, with a well-marked sucking-disk. The three longitudinal series, into which they are collected, are broadest near the middle of the body, where four, five, or even six pedicels are placed side by side. Anteriorly and posteriorly each series decreases and consists finally of a double row of "papillæ" which have taken the place of the pedicels. The papillæ are very small, with broad rounded base and pointed top; they are scattered over the dorsal ambulacra and interambulacra, those belonging to the ambulacra being slightly larger, 2 or 3 mm. long. Even the ventral interambulacra carry such papillæ, which are more closely placed towards the middle of the ventral surface, especially along the sides of the series of pedicels; when retracted, the ambulacral appendages or papillæ which have their place in the neighbourhood of these series almost resemble the true pedicels, but differ from them mainly by their smaller size. Only very few are extended, and these present a conical form. The groups of larger papillæ round the mouth are well marked, each group is composed of two or three papillæ united at their bases. The anal teeth are hard and rounded, measuring about 4 mm. in length and breadth.

The calcareous ring (Pl. V. fig. 4*a*) is very strongly constructed, and measures about 37 mm. in diameter; it is composed of ten pieces without any posterior prolongations. The madreporic canal is single, dorsal, and attached to the mesentery. The single Polian vesicle is very voluminous, and has a length of 50 mm. The retractors are slender, attached at about the first third of the body. The reproductive organ consists of two very thick bundles of simple, unbranched, narrow tubes, from 40 to 50 mm. long. The ampullæ of the pedicels and papillæ depend freely into the peritoneal cavity and have a considerable length, those belonging to the pedicels measuring 12 mm. The cloaca and the respiratory organs are well developed.

The most obvious characteristic of the species in question is to be found in the deposits, which, instead of filling up the perisome, making it hard and inflexible, are comparatively small and scattered. They present a very irregular aspect (Pl. V. fig. 4*b*), some being round, oval or elongate, and usually pierced by very few holes, others resembling rods or × -shaped bodies. The more strongly developed oval deposits measure 0·09 or 0·1 mm. in length, and bear some resemblance to buttons. The pedicels contain, excepting terminal plates, very few perforated rod-like plates near their extremities (Pl. V. fig. 4*c*). The small papillæ are even strengthened by a few irregular rods and a very feebly developed terminal plate; sometimes they almost seem to be devoid of deposits. In the larger papillæ, which I have been able to examine, I have found larger irregular thick scales composed of several reticulate layers, and even, though more rarely, simple perforated plates. These scales have a diameter of 0·6 mm.

Colochirus challengeri, n. sp. (Pl. XIV. figs. 1, 2; Pl. VI. fig. 11).

Body elongate, quadrangular, tapered towards each extremity. Mouth closed by five valvular projections. Anus surrounded by several sharp teeth, and the anal portion of the body slightly turned upwards and provided with overlapping scales. The ventral tentacles considerably smaller than the rest. Body-wall hard, leathery, almost inflexible, and its surface covered with numerous small, rounded, white, hard, calcareous protuberances, which are more crowded on the ventral than on the dorsal surfaces. Each protuberance penetrated by a small retractile pedicel. These protuberances are very closely disposed even on the two dorsal angles, giving these the aspect of two longitudinal rough and hard ridges. Along the four angles of the body a simple row of larger, scattered prominences, perforated by the pedicels, is visible. No arrangement of the ventral pedicels in distinct rows. Deposits—larger and smaller, thick reticulate scales; numerous irregular knobbed buttons with as many as sixteen or more holes; and small flat knobbed cups made up of a central ×-shaped rod and a knobbed ring. Length about 150 mm. Colour in alcohol, dark brownish-grey, with lighter longitudinal bands along the ambulacra and with all the protuberances whitish.

Habitat.—Station 186, September 8, 1874; lat. 10° 30′ S., long. 142° 18′ E.; depth, 8 fathoms; coral mud; three specimens.

This very characteristic species is nearly allied to *Colochirus spinosus* and *Colochirus inornatus*, and forms together with them a remarkable exception to the general rule in having no distinct longitudinal rows of pedicels on the ventral surface. I cannot agree with Semper in referring them to the genus *Thyone*, but von Marenzeller is doubtless right in regarding them as more nearly related to *Colochirus* on account of their general habit, the conformation of the calcareous ring and of the calcareous deposits, &c.

In two of the specimens not only the anal but even the oral portions of the body are bent upwards. The ventral surface with its two interambulacra is almost flat, slightly convex or slightly hollowed; a ridge is distinguishable along its odd ambulacrum only anteriorly and posteriorly, and by reason of this the extremities of the body present a more or less distinct pentangular aspect, while the rest of the body is quadrangular, with the two dorsal angles very well marked. The oral as well as the anal portions of the body are scaled, while no overlapping scales are to be found on the rest of the body, which is covered by a great number of small, hard, rounded, whitish elevations or protuberances penetrated by the pedicels. Like *Colochirus spinosus* this species is marked out by series of larger conical calcareous points or processes, and these are to be observed not only along the ventral lateral ambulacra, but even on the dorsal angles. I counted as many as eight or nine such points. So far as I can find, no distinction of importance exists between the dorsal and ventral pedicels. Both are

provided with supporting rods and terminal plates, but possibly the latter are more developed in the ventral pedicels. The pedicels always run out from the above mentioned hard, whitish elevations or points, which are pierced by them.

Only a single madreporic canal and Polian vesicle are present. The three ventral pieces of the calcareous ring (Pl. VI. fig. 11*d*) are narrower than the rest, and the posterior margin of the ring is uneven on account of the presence of short prominences.

The perisome is very hard and thick from the occurrence of three kinds of deposits, which bear a great resemblance to those in *Colochirus spinosus* and *Colochirus inornatus*. The scales do not attain any great size, excepting in the extremities of the body, where they are rather large, broad, visible to the naked eye, and slightly cover one another at the edges. The buttons (Pl. VI. fig. 11*a*) are very numerous, and vary greatly in form, size, and general appearance, scarcely any two being alike. They are distinctly knobbed, and pierced by holes varying in number from three or four to sixteen or more. The largest buttons attain a diameter of 0·2 mm. or more. Sometimes the buttons are almost smooth without knobs. The cups (Pl. VI. fig. 11*b*) are very flat, and do not seem to be present in very great abundance. They are mostly built up after the same plan as those in *Colochirus inornatus* or *Colochirus spinosus*, with the inner surface bluntly knobbed and the outer provided with more pointed knobs or spines. Sometimes an incomplete network covers the concave part of the cups. Their largest diameter measures about 0·06 mm. The pedicels are strengthened by simple or branched, broader or narrower, perforated rods (Pl. VI. fig. 11*c*) and by a well-developed terminal plate.

Colochirus quadrangularis, Lesson, 1830 (Pl. XIV. figs. 7, 8; Pl. VI. fig. 7).

Habitat.—Station 203, October 31, 1874; lat. 11° 6′ N., long. 123° 9′ E.; depth, 20 fathoms; mud; one specimen.

So far as I can find, no satisfactory description has been given either of this species or of *Colochirus tuberculosus*, so that it is very difficult, if not impossible, to get a correct idea of their appearances and distinguishing characters. Notwithstanding this, I cannot hesitate to refer the animal brought home by the Challenger Expedition from the Philippine Islands to the species in question.

The body, which has a length of about 90 mm., is distinctly quadrangular, with a simple row of large conical processes along each angle. The number of processes in each row is from twelve to sixteen. Anteriorly and posteriorly the odd ventral ambulacrum is provided with two or three processes. The flat ventral sole-like surface is marked by three longitudinal series of retractile pedicels, each series being composed of five or six rows. The ventral narrow interambulacra are naked, as well as the three dorsal ones. The longest process has a length of about 12 mm. and a breadth at the base of about

6 mm. The mouth is closed by five processes or valves, which carry some smaller protuberances. The anus is slightly turned upwards, and situated much nearer the dorsal than the ventral surface; it is surrounded by five small conical teeth, alternating with five broader scales.

The perisome is hard and leathery from several kinds of deposits. The rounded or oval, thick, reticulate bodies, or, as I prefer to call them, scales, do not attain so large a size as in the preceding species, but are, on the contrary, rather small in comparison with the size of the animal. Semper seems to deny their presence. The spheres are often incomplete and of varying shape (Pl. VI. fig. 7*a*). In the external layer of the integument the "hemispheres" or cups are to be found (Pl. VI. fig. 7*b*); they very seldom present a regular appearance, hardly two being alike. In most cases they are very slightly concave, perforated by several holes, of which the four central are usually largest, and their rim is provided with spines, which are sometimes confined to one end of the flat oval plate-like cups. One or several spinous or smooth beams cross the cups on their concave side. These cups are much more finely constructed than the spheres. The pedicels are supported by terminal plates, numerous transverse perforated rods of varying shape (Pl. VI. fig. 7*c*), and perforated, irregular, flat, knobbed cups (Pl. VI. fig. 7*d*).

The three ventral pieces of the calcareous ring are considerably narrower than the rest. A single Polian vesicle is present. Numerous small madreporic canals, of which one is slightly larger and situated in the dorsal mesentery, also occur.

Colochirus cucumis, Semper, 1868 (Pl. XIV. figs. 9, 10; Pl. VI. fig. 9).

Habitat.—Station 203, October 31, 1874; lat. 11° 6′ N.; long. 123° 9′ E.; depth, 20 fathoms; mud; a single specimen.

The body is very distinctly quadrangular, excepting anteriorly and posteriorly, where it is pentangular, the odd ambulacrum being there more prominent so as to form a fifth angle. The two dorsal angles carry conical tubercles or processes of unequal size, some being very small, and arranged in an irregular zigzag row. Moreover, the three ventral ambulacra also carry such tubercles anteriorly and posteriorly. The dorsal interambulacra have but few tubercles. In the specimen I have seen, the mouth and anus are bent upwards, and the former is closed by the five characteristic triangular valves. No imbricating scales occur round the anus. The three double rows of pedicels are very distinct.

The deposits are of several different kinds—large rounded or oval reticulate thick scales; rounded or oval reticulate spheres, about 0·09 mm. in diameter (Pl. VI. fig. 9*a*); smaller, more delicately constructed spheres (Pl. VI. fig. 9*b*), about 0·04 mm. in diameter;

and small hemispheres (Pl. VI. fig. 9*c*) of about the same size as the smaller spheres, provided with spines round the rim and on the network which closes the openings of those half-spheres.

Colochirus australis, Ludwig, 1875 (Pl. XIV. figs. 5, 6 ; Pl. VI. fig. 6).

Habitat.—Port Jackson (Australia) ; 6 to 7 fathoms ; a single specimen.

Though the individual obtained during the Challenger Expedition deviates in some points from the types described by Ludwig, I do not hesitate to consider them as identical forms. The animal has a length of about 75 mm. Anteriorly and posteriorly the body is distinctly pentangular, but towards its middle the odd ambulacrum becomes less distinctly angular. The anal teeth are indistinct. The mouth is closed by the usual five valves. The colour is darkish brown, with five lighter longitudinal bands, of which the three corresponding to the ventral ambulacra are almost yellowish. The surface of the skin is rough, especially on the dorsum, where the scales are much larger.

The dorsal tubercles or processes are small and not very prominent, some of them being of minute size. They are to be found only on the ambulacra, where they form a double row anteriorly but are situated in a zigzag line towards the posterior extremity of the body. The pedicels are arranged in a distinct double row along each ventral ambulacrum. The base of each pedicel is surrounded by a crown of small prominent scales (Pl. VI. fig. 6*d*), and the dorsal tubercles seem also to be formed by such scales, in the middle of which the dorsal ambulacral appendages are situated.

The scales are much larger in the dorsal perisome, especially along the ambulacra, where they form longitudinal series. The largest scales have a diameter of about 4 mm. Besides these deposits, numerous more or less irregularly formed, knobbed buttons (Pl. VI. fig. 6*a*), and scattered reticulate hemispheres (Pl. VI. fig. 6*b*), are to be found. Among the larger buttons, several more finely constructed smaller ones are seen. The pedicels have perforated rods and terminal supporting plates. A single Polian vesicle and madreporic canal are present. The three ventral pieces of the calcareous ring are narrower than the rest.

Colochirus pygmæus, n. sp. (Pl. IV. fig. 9).

Body elongate, decreasing posteriorly into a narrower caudal portion, quadrangular or rather pentangular. Mouth closed by five projections or valves. Anal portion of the body without visible scales and teeth. Ventral surface with three distinct series of pedicels, each composed of a double row ; anteriorly and posteriorly the pedicels are converted into conical non-retractile processes of about the same size as the pedicels, but

arranged in simple or double alternating rows. The two dorsal ambulacra have conical, non-retractile processes in a zigzag row. The interambulacra naked. Deposits—small reticulate cups with very spinous rims; crowded symmetrically formed buttons, with as a rule four holes and about ten knobs; and larger scales resembling simple perforated plates with uneven surfaces. Colour in alcohol, brownish. Length about 25 mm.

Habitat.—Bahia, September 1873; depth, 7 to 20 fathoms; a single specimen.

The body of this small species is provided with sharp angles along the four ambulacra, and with a more obtuse angle along the odd ventral one. As noted in the diagnosis, the pedicels and processes are confined to the ambulacra, but, to judge from the only specimen I have seen, a tendency to spread over the odd dorsal interambulacrum may be observed, a few very minute processes being situated near its middle line.

There is no doubt that this species is nearly related to Ludwig's *Colochirus australis*, though it differs from it in several important characters. Thus, the scales in the perisome are especially distinct, those of *Colochirus australis* being much larger, thicker, and composed of several superposed layers, thus constituting true net-shaped scales, while the "scales" of *Colochirus pygmæus* (Pl. IV. fig. 9*a*), composed of a single layer, resemble common, simple perforated plates, and do not exceed 0·5 mm. in length. These scales or plates are not crowded, but very scattered; they are mostly of an elongated form, several times longer than broad, and have the surfaces uneven from the presence of low knobs or elevations. The buttons (Pl. IV. fig. 9*b*) have a diameter of 0·08 mm., but often much smaller ones may be found; they do not seem to vary greatly in general appearance. The cups (Pl. IV. fig. 9*c*, *d*), which lie most externally in the perisome, are very minute, 0·028 mm. in diameter, and deeply hollowed; their free rim is provided with numerous processes or spines. The entire cups are built up of a strong ×-shaped body with the arms curved, sometimes slightly branched. The pedicels and processes are supported by transverse, perforated rods, mostly with a third arm at the middle (Pl. IV. fig. 9*e*).

From want of materials, I could not examine the internal organisation.

Genus *Actinocucumis*, Ludwig, 1875.

Actinocucumis typica, Ludwig, 1875 (Pl. XII. figs. 4, 5).

Habitat.—Station 186, September 8, 1874; lat. 10° 30′ S., long. 142° 18′ E.; depth, 8 fathoms; coral mud; a single specimen.

There is nothing to add to the description of Ludwig, excepting that I find some minute papillæ even on the ventral surface in the anterior and especially in the posterior parts. The pedicels seem to be rather stiff. According to Ludwig, the species has been previously obtained from Amoy (China) and Bowen (Australia).

Subfamily Gastropoda.

Genus *Psolus*, Oken, 1815.

Psolus disciformis, n. sp. (Pl. IX. fig. 6).

Body rounded, oval, depressed, with the anal portion slightly conical. Within the anal aperture five small tooth-like papillæ. Tentacles ten (?). The dorsal scales are numerous and imbricating, smaller round the margin of the dorsal surface and round the anal and oral apertures. Most of the scales carry one or two minute papillæ, visible to the naked eye, and apparently running out from a hole in the scale; these papillæ are always strengthened by rudimentary minute terminal plates. The oval sole provided with three double rows of pedicels, the pedicels of the lateral ambulacra being much more numerous and crowded than those of the middle ambulacrum. The sole is supported by regularly formed, smooth oval, roundish or even elongated disks with the margin slightly uneven, and with no holes or a few minute ones; moreover, the sole contains a few smaller × -shaped bodies or larger concave cup-shaped plates with a few large holes and an uneven knobbed rim. Pedicels with well-developed terminal plates, and irregular, perforated, rod-like plates. Colour, white. Length of the largest specimen, 25 mm.

Habitat.—Station 311, January 11, 1876; lat. 52° 45′ 30″ S., long. 73° 46′ W.; depth, 245 fathoms; bottom temperature, 46°·0; blue mud; two specimens.

In both of the specimens examined by me the anal portion of the body is more distinctly conical and prominent than the mouth. No oral or anal valves are present, but the scales seem to overlap each other in the neighbourhood of the two apertures more distinctly than on other parts of the body. The margin of the dorsal surface is formed by minute plates. The scales between the mouth and anus amount to about thirty or more. The scales themselves are roundish, and their diameter slightly exceeds 1 mm. The minute dorsal papillæ are remarkable in having a network resembling the rudimentary terminal plates of pedicels, and I am almost tempted to believe these "papillæ" to bear some relation to the ambulacral system. At both extremities of the sole the lateral double-rows of pedicels are in direct communication with one another. That which especially distinguishes this species from the forms hitherto known is the very peculiar discoidal smooth plates (Pl. IX. fig. 6*a*) present in the ventral sole, and which are far more numerous and crowded than the scattered × - or cup-shaped plates (Pl. IX. fig. 6*b*); the diameter of these disks and plates measures about 0·14 mm.

Psolus murrayi, n. sp. (Pl. XV. figs. 5, 6; Pl. VI. fig. 4).

Body not depressed, elongate, cylindrical, with the posterior end tapered, caudiform. The elongated rectangular sole provided with three simple rows of pedicels, those in the

middle row fewer and more distant from one another. Tentacles ten (?). The dorsal scales seem not to imbricate, and are covered by a thick integument containing numerous more or less irregularly formed reticulate cups. The dorsal surface is not smooth but rough with numerous small warts, and the scales are not visible exteriorly. The sole is strengthened by large perforated plates and small irregular cups. Length, 28 mm.

Habitat.—Station 320, February 14, 1876; lat. 37° 17′ S., long. 53° 52′ W.; depth, 600 fathoms; bottom temperature, 37°·2; green sand; a single specimen.

The general shape of the body bears some resemblance to that of *Psolus phantopus*, its caudal portion being conical and the ventral sole elongated and rectangular. At first sight one is almost tempted to believe that the perisome is devoid of scales, but a closer examination reveals their presence, though they are covered by a thick warty integument, filled with minute very irregular, reticulate cups, which sometimes take the shape of spheres. The scales are irregularly rounded, and do not seem to imbricate one upon the other. No oral or anal valves are present. The warts, visible exteriorly, appear to be formed by a network of the same structure as that which composes the scales themselves. The three series of pedicels are each made up of a simple row, the lateral containing about eighteen, and the median about nine pedicels. The three rows seem not to be confluent at the extremities as is the case in most of the species of this genus. The perisome of the sole contains large irregular, smooth perforated plates (Pl. VI. fig. 4*a*), as well as cups (Pl. VI. fig. 4*b*) resembling those in the dorsal body-wall. The tentacles are retracted, but probably ten in number.

The determination of the various species of this very interesting genus is indeed a very difficult task. They seem to form a continuous chain of transitional forms combining the extremes, and further investigations will probably result in the union of several forms which are now considered to be distinct species. *Psolus murrayi*, however, must be looked upon as a characteristic form.

Psolus incertus, n. sp. (Pl. VIII. fig. 4; Pl. VI. fig. 5).

Body not depressed, elongate, cylindrical, with the anal portion short, conical. Pedicels only round the margin of the ventral sole, arranged in two rows. Tentacles ten (?). The scales small, very numerous, and overlapping; they have one, two, or three small pores. No oral or anal valves. The sole supported by small irregular plates perforated by a few holes. Length, 20 to 35 mm.

Habitat.—Station 150, February 2, 1874; lat. 52° 4′ S., long. 71° 22′ E.; depth, 150 fathoms; bottom temperature, 35°·2; coarse gravel. Station 151, February 7, 1874; off Heard Islands; lat. 52° 59′ 30″ S., long. 73° 33′ 30″ E.; depth, 75 fathoms; volcanic mud. Station 149c, Royal Sound (Kerguelen), January 19, 1874; lat. 49° 32′ S., long. 70° E.; depth, 60 fathoms; volcanic mud. One specimen from each locality.

Bell has recently described a new species, *Psolus* (*Hypopsolus*) *ambulator*, which is distinguished by its scales being provided with pores, which are the orifices of small pits in the substance of the scales themselves. In the species examined by me, the pores evidently penetrate the scales (Pl. VI. fig. 5*a*, *x*). By a very careful examination, one finds these pores to be minute spots or rings scattered over the surface of the animal. Having had only three small individuals at my disposal, I have not been able to make any closer anatomical researches, although this would have been very desirable, in order to get an idea of the function of these pores. Possibly they are in connection with the ambulacral system. The tentacles are retracted and not visible externally. The outer row of pedicels is situated in the margin of the sole. The deposits of the sole are few, and present the form of small irregular plates with two to four holes (Pl. VI. fig. 5*b*); the larger specimens seem to be devoid of any deposits in the sole.

Psolus operculatus, Pourtalès, 1868.

Habitat.—Station 49, May 20, 1873; lat. 43° 3′ N., long. 63° 39′ W.; depth, 85 fathoms; bottom temperature, 35°·0; gravel, stones; numerous small specimens. Station 320, February 14, 1876; lat. 37° 17′ S., long. 53° 52′ W.; depth, 600 fathoms; bottom temperature, 37°·2; green sand; several specimens.

So far as I can see, the greatest similarity exists between the Challenger specimens and those described by Pourtalès. The largest specimens have a length of about 20 mm.; the smallest are 8 mm. long, thus being very young. The body is oval, rounded, or elongate, flattened, mostly decreasing in height posteriorly. The mouth is closed by five larger triangular valves, which often alternate with some smaller valves. The plates closing the anus are much less regularly arranged. In the smallest individuals the oral and anal scales are more irregular and inconstant. The scales are almost smooth in the larger forms, but finely granulated and comparatively larger in the young; they overlap a little. The largest scales measure 4 mm. in diameter, thus being rather large in comparison with the size of the animal. A double row of pedicels surrounds the thin, soft, transparent sole, those of the outer row being smaller and situated on the inner side of the margin. The deposits of the sole consist of closely crowded, more or less cup-shaped, concave plates, with as a rule four large perforations, and several rather long knobs, which occur especially on the uneven rim; moreover, numerous incompletely developed, ×-shaped deposits, with the arms dichotomously branched, are to be found among the former. Some of the plates are of a more solid structure than the rest.

The specimens brought home from Station 320 evidently form a transition between *Psolus operculatus* and *Psolus squamatus*; I cannot state that they belong either to the one or the other of these two species. The largest individuals are about 20 mm. long, the smallest 4 to 5 mm. The oral and anal scales are much more irregular than seems to be

the case in *Psolus operculatus*. The deposits of the sole are very densely crowded, being larger, more plate-like, and provided with more holes than in the forms dredged at Station 49. In some specimens a few pedicels may be found on the odd ambulacrum.

Psolus antarcticus, Philippi, 1857 (Pl. XV. figs. 3, 4; Pl. VI. fig. 1).

Habitat.—Station 308, January 5, 1876; lat. 50° 8′ 30″ S., long. 74° 41′ W.; depth, 175 fathoms; blue mud; six specimens. Station 320, February 14, 1876; lat. 37° 17′ S., long. 53° 52′ W.; depth, 600 fathoms; bottom temperature, 37°·2; green sand; a single very small specimen.

Though this species is doubtless nearly allied to the northern forms, especially *Psolus squamatus*, it differs considerably in several important points, and a comparison of the Arctic and Antarctic representatives will clearly show that they are distinct. The six specimens I have had at my disposal were all collected near the west coast of Patagonia, not far from the Strait of Magellan, so there can be but little doubt that they really belong to the species described by Philippi.

The largest specimen has a length of 50 mm. The body-form is like that of *Psolus squamatus*. The mouth is closed by five very large triangular valves, the sides of which are almost equal. In the largest specimen, which I am about to describe, the length of the sides of these triangular scales is 9 mm.; their slightly curved bases, being distinctly marked, give rise to a circular or angular ring. In two of the specimens, however, some of the oral scales are parted in two, thus presenting a more irregular arrangement. In the same manner, the anal aperture is closed as a rule by five distinct though much smaller scales, which give rise to a smaller anal circle round their base. The scales are almost smooth or very finely granulated, and do not overlap each other so much as is the case in the Arctic forms, and those which lie close to the oral scales seem often to be of considerable size. Very minute scales surround the margin of the dorsal surface. Seven to nine scales occur between the oral and anal scales. In all the specimens I have seen the scales have a brownish colour, excepting round the free margin, where a broad brim of a light greyish colour occurs.

The flat ventral sole is constantly surrounded by only two rows of pedicels, the exterior of which is situated in the sharp margin itself and contains much smaller pedicels. Anteriorly, and sometimes posteriorly, the odd ambulacrum carries very few—two, three, or four—pedicels. The deposits in the sole (Pl. VI. fig. 1) consist of irregularly perforated plates, with in most cases numerous distinct knobs; very seldom a plate devoid of knobs is to be found. Sometimes the plates are slightly hollowed so as to take the shape of very flat cups.

I have been able to compare this species with equally large specimens of *Psolus fabricii* and *Psolus squamatus*. I never found in them the well-marked oral and anal

valves, these openings being surrounded by circles of numerous scales which seem to decrease towards the openings themselves, so that the number of scales between the mouth and the anus was greater. Only in very small specimens (about 15 mm.) of *Psolus squamatus* have I observed a more or less regular arrangement of larger oral and smaller anal valves, but I have never observed this in *Psolus fabricii*, though I have examined much smaller individuals of this species. Moreover, there is a great difference in the arrangement of the pedicels, when comparing specimens of about the same size. As has been pointed out, *Psolus antarcticus* has two rows of pedicels, while equally large specimens of *Psolus squamatus* (about 50 mm. long) always have three rows. Even the odd ambulacrum in the northern form seems to have more pedicels. The deposits in the sole of *Psolus squamatus* resemble those in the same region of *Psolus antarcticus*, but they often seem to be devoid of knobs or other processes.

The specimen brought home from Station 320 is very small, 13 mm. long, and has the oral and anal valves very regularly arranged. Its pedicels are disposed in two rows round the sole, which seems to be completely devoid of deposits. The scales are comparatively large, so that only four are situated between the oral and anal valves. The surface of the scales is nearly smooth. Having seen only a single specimen, I could not make any detailed examination, but it seems probable that it belongs to the species in question.

Psolus squamatus, Düben and Koren, 1844 (var. ?) (Pl. XV. figs. 1, 2 ; Pl. VI. fig. 2).

Habitat.—Station 307, January 4, 1876 ; lat. 49° 24′ 30″ S., long. 74° 23′ 30″ W.; depth, 140 fathoms ; blue mud; two specimens. Station 308, January 5, 1876 ; lat. 50° 8′ 30″ S., long. 74° 41′ W.; depth, 175 fathoms ; blue mud ; two specimens. Station 311, January 11, 1876 ; lat. 52° 45′ 30″ S., long. 73° 46′ W. ; depth, 245 fathoms ; bottom temperature, 46°·0 ; blue mud ; several specimens.

The four individuals brought home from Stations 307 and 308 are rather large, varying from 50 to 60 mm. in length. If not identical, they cannot be considered as anything more than varieties of the northern form. They even seem to combine this form with *Psolus antarcticus*. A double row of pedicels surrounds the sole, those in the outer row being situated on the inner side of the margin. Strangely enough, one of the specimens obtained at Station 307 possesses pedicels on the odd ambulacrum, and these form a simple row at the middle of the body but an alternating double row posteriorly and anteriorly. Considering the fact that the other specimens are in want of the middle row of pedicels, and having regard to the general appearance of the body, it is most probable that this peculiarity may be referred to an individual deviation. The scales bear small rounded granules which occur especially round the free margin ; the oral aperture is closed by five larger triangular scales, alternating with and partly

covering five (or more) narrow, smaller tooth-shaped ones; the anal plates are smaller than the surrounding plates and irregularly disposed, no distinct valves being visible. The largest plates between the mouth and anus measure 5 mm. in diameter. The perforated plates of the sole (Pl. VI. fig. 2) are more or less irregularly formed, in one specimen being almost smooth, in another provided with distinct not very numerous knobs. So far as I can discover, this form must be very nearly related to *Psolus operculatus*, of which species, however, I have not had the opportunity of seeing any types.

The specimens dredged at Station 311 are much smaller, the largest being 30 mm. long and the smallest 20 mm. The slightly elevated anal portion is devoid of valves, and often even at the mouth no larger scales are to be distinguished. The body is covered by a large number of scales. The granulation of the dorsal scales is very fine. The thin almost transparent sole has only few more or less incompletely developed × - or plate-like deposits. These specimens must be closely allied to Bell's *Psolus peronii*, but differ from it by the form of the deposits in the sole.

Psolus ephippifer, Wyville Thomson, 1876 (Pl. XV. figs. 7–11; Pl. VI. fig. 3).

Body oval or almost cylindrical, not very depressed, about as high as broad. The oral aperture closed by five large triangular valves, and a less regular valvular arrangement covering the anal opening, which in some specimens seems to lie on the top of a small elevation. A double row of pedicels surrounding the sole, those in the outer row situated on the inner side of the margin. Anteriorly and posteriorly the odd ambulacrum is provided with a few pedicels. The irregular scales do not overlap each other very much, excepting round the margin, where they are of minute size. In some specimens the scales are almost smooth, in others, on the contrary, distinctly granulated. In the female, the dorsal surface has a well-defined saddle-like elevation formed of large tesselated plates of somewhat irregular form and with the surface smoothly granulated. Deposits in the sole—numerous more or less crowded, reticulate, knobbed, cup-like plates. Length about 40 mm.

Habitat.—Station 151, February 7, 1874; off Heard Islands; lat. 52° 49′ 30″ S., long. 73° 33′ 30″ E.; depth, 75 fathoms; volcanic mud; about forty specimens. Station 150, February 2, 1874; lat. 52° 4′ S., long. 71° 22′ E.; depth, 150 fathoms; bottom temperature, 35°·2; coarse gravel; two specimens. Royal Sound, Kerguelen; depth, 20 to 60 fathoms; one specimen. Marion Islands; numerous specimens. Station 145A, December 27, 1873; lat. 46° 41′ S., long. 38° 10′ E.; depth, 310 fathoms; volcanic sand; one individual.

Sir Wyville Thomson has already published the supposition that this species is nearly related to or possibly a variety of *Psolus operculatus*, and, indeed, they seem to present a great resemblance. It is almost impossible to point out any difference of importance

between the respective males. Both of them have the characteristic oral and anal valves, and a double row of pedicels, the exterior of which is situated on the inner side of the margin. In these points the three species, *Psolus antarcticus*, *Psolus operculatus*, and *Psolus ephippifer* seem to agree and to be distinguishable from the northern forms *Psolus fabricii* and *Psolus squamatus*, which when fully developed have more rows of pedicels and are devoid of any valves.

No other species of *Psolus* exists, which presents such a marked difference between the males and females. The former have no marsupium in the dorsal body-wall, which is thick, leathery, with numerous irregularly formed imbedded scales; moreover, the scales are not of equal size, some of them in the middle of the back being considerably larger, and they seem to overlap each other but very slightly. The granulation is in these male specimens very fine. There also have been brought home from the same locality numerous specimens which have the scales more distinctly overlapping, of more equal size, and rough from the presence of granules; in some specimens the granules are so crowded that no scales are visible. The extremes look so very different that one may be tempted to regard them as distinct species. Among forty specimens dredged at Station 151, twenty-seven are males and the rest females.

The females are peculiar on account of their saddle-like elevation, which is well-defined in the middle of the back and formed of large tesselated scales with the surface smoothly granulated. These scales are not of the same simple conformation as the other scales, but they are supported by a central column raised up on an expanded irregular foot-like portion imbedded in the perisome (Pl. VI. fig. 3, *a*). Thus, each scale has the aspect of a card-table formed by two irregular parallel disks united by a central column. Consequently, when the disks are fitted together edge to edge, a cloister-like space is left between their supporting columns. In this space or marsupium the eggs are hatched. On removing some of the plates one finds young in their early stages enclosed within that cloister-like marsupium.

To judge from a young immature specimen, 17 mm. long, the lower part or foot of the scales, which constitutes the marsupium, is formed first, the column and the disk or upper part being developed later by a kind of budding; consequently, in young forms the marsupium does not form a closed space owing to the interstices between the disks or upper parts of the scales. As the animal grows larger, these interstices become smaller and smaller, so that finally the angular disks are accurately fitted to one another. I may be allowed to quote the following words from the description of Wyville Thomson :—"As the embryos increase in size, the marsupium projects more and more, and at length the joints between the plates begin to open, and finally they open sufficiently to allow the escape of the young. The young in one marsupium seem to be all nearly of the same age. In *Psolus ephippifer* the marsupium occupies the greater part of the dorsal surface, and its passages run close up to the edge of the mouth, so that the eggs pass into them at once from the

ovarial opening without exposure." In the specimens I examined the marsupium seems not to run so far forwards as is pointed out by Wyville Thomson. Owing to the want of the necessary material I could not find the genital pore, but I am tempted to believe that it is situated more anteriorly than Wyville Thomson supposes.

The "sole" is supported by more or less irregular perforated flat cups (Pl. VI. fig. 3, *b*) with more or less numerous obtuse spines. Very often the "cups" are undeveloped, resembling irregular, reticulate, knobbed or spinous plates. A single madreporic canal and Polian vesicle are present.

Among the numerous specimens from Marion Islands, not a single one is provided with a marsupium on the dorsal surface, though there are females as well as males to be found. They resemble the true *Psolus ephippifer* almost completely, and differ only, so far as I can find, by having a slightly more distinctly marked conical anal portion. However, the presence or absence of a marsupium in the females may possibly be of such importance as to justify their separation into two species, in which case the forms from Marion Islands probably may be referred to *Psolus operculatus*, Pourtalès.

Subfamily Sporadipoda.

Genus *Thyone*, Oken, 1815; Semper, 1868.

Thyone fusus, var. *papuensis*, nov. (Pl. VII. fig. 1).

Habitat.—Station 186, September 8, 1874; lat. 10° 30′ S., long. 142° 18′ E.; depth, 8 fathoms; coral mud; a single specimen.

Though it may appear very strange, it is nevertheless true that the form brought home from Torres Strait is closely allied to the northern *Thyone fusus;* indeed, so much is this the case that I cannot find out any difference of importance, although I have had at my disposal a vast collection of northern forms from the west coast of Sweden, and have had the best opportunity of making comparisons between them.

The specimen from Torres Strait measures 34 mm. in length; its pedicels are small and very numerous, and are distributed over the ambulacra as well as interambulacra. Traces of an arrangement of the pedicels in longitudinal series are recognizable not only along the ambulacra but even along the interambulacra. Like the northern form, the anus is armed with calcareous teeth. Even the calcareous ring (Pl. VII. fig. 1, *a*) does not deviate in general appearance from that of the northern type; only with regard to the size, some difference seems to exist. Thus, the length of the ring in the specimen brought home by the Challenger Expedition is about 16 mm., while in a specimen of the typical *Thyone fusus*, about 70 mm. long, it is only 14 mm. long. But in both forms the posterior long prolongations seem to be composed of several smaller parts.

The calcareous deposits of the perisoma itself (Pl. VII. fig. 1, *b*), as well as of the pedicels (Pl. VII. fig. 1, *c*), are of quite the same conformation. Nevertheless, a small difference seems to exist; as a rule, the disks of the tables of the typical form are perforated by four holes, though they often have more, while the disks in the Challenger specimen have as a rule four larger central and four more peripheral small holes.

Thyone pervicax, n. sp. (Pl. V. fig. 9; Pl. XII. fig. 3).

Body elongate, cylindrical, equally rounded at both extremities. Mouth closed by five prominences of the perisome, stellate. The two ventral tentacles considerably smaller than the rest. Anus without teeth. Body covered by small, conical, hard, close-lying papillæ, carrying the pedicels. No arrangement in rows visible. The body-wall very thick and hard from crowded deposits of three kinds—cups; knobbed buttons usually with four holes; and larger, rounded, mulberry-like, scale-like bodies. Pedicels strengthened by irregular perforated plates or rods and terminal plates; the dorsal pedicels more conical, and with the terminal plates more rudimentary. Colour in alcohol, brownish. Length, 60 or 65 mm.

Habitat.—Station, Bahia; depth, 7 to 20 fathoms; a single specimen.

This species (Pl. XII. fig. 3) is remarkable in possessing hard conical papillæ crowded all over the body, on the top of which the pedicels are situated, thus presenting some similarity to Studer's *Trachythyone*. The dorsal pedicels do not seem to be so well developed as the ventral, their sucking-disks being rounded and their terminal plates more rudimentary. The thickness of the perisome, the stellate mouth, and the three kinds of deposits point to a certain relation to the genus *Colochirus*.

The calcareous ring (Pl. V. fig. 9, *a*) is composed of ten simple pieces, the radial with a deep incision posteriorly as well as anteriorly, giving the aspect of short, posterior prolongations. The three ventral pieces are slightly smaller than the rest. A single Polian vesicle and madreporic canal are present. The retractors communicate with the longitudinal muscular bands at about the first fourth of the body. The reproductive organs are well developed, consisting of numerous slender, simple tubes. The respiratory-trees are nearly of the same length as the body itself.

The outermost layer of the perisome contains the cups (Pl. V. fig. 9, *b*), which are pierced by four holes, and have the spinous rim directed outwards; their diameter measures about 0·048 mm. The very numerous buttons (Pl. V. fig. 9, *c*) are oval, 0·12 mm. long, and usually distinguished by four holes and a smaller number of large knobs. The mulberries are scattered among the former, and have a diameter of about 0·4 mm.

There seems to be reason to refer this species to the genera *Cucumaria* and

Colochirus as well as to *Thyone*, in consequence of the shape of its calcareous ring and calcareous deposits.

Thyone recurvata, n. sp. (Pl. V. fig. 7; Pl. VIII. fig. 6).

Body fusiform, tapered posteriorly into a long narrower caudal portion, curved, with the extremities turned upwards. Tentacles ten (?), retracted. Pedicels numerous, distributed all over the body, more densely crowded on the ventral surface, hard, stiff and not retractile. Anus without teeth. Perisome hard, brittle from close-lying, large, irregular, smooth plates with numerous holes; the plates overlap each other more or less. The exterior layer of the perisome contains a quantity of small cups, made up of an × -shaped body with the arms curved and their ends united to a spinous rim. Pedicels strengthened by about the same kinds of deposits, though the plates are more deformed and rod-like towards the terminal plates. Colour in alcohol, light yellowish, whitish. Length about 55 mm.

Habitat.—Kerguelen Islands; depth, 10 to 100 fathoms; a single specimen.

The form of the body reminds one of that in *Thyone raphanus*, &c. The shorter dorsal surface and the posterior and anterior portions of the ventral surface have the pedicels about equally distributed, while those on the remaining middle part of the ventral surface are much more densely crowded. No arrangement of the pedicels in rows is discernible. The tentacles are small and completely retractile, consequently I have not been able to study their form and number; it seems as if some of them are considerably smaller than the others.

The calcareous ring is very small, only about 3 mm. in diameter, and its posterior undulating margin is devoid of any prolongations; it is composed of ten simple pieces. Three Polian vesicles and a single madreporic canal are present. The retractors are attached somewhat in front of the middle of the body, and some of them are remarkable by being bipartite or tripartite towards their posterior ends; moreover, the tripartite retractor is attached to three different longitudinal muscular bands, which doubtless is an abnormality. The reproductive organs consist of two small bundles of short simple tubes. The respiratory-trees are not very richly provided with short branches. The cups (Pl. V. fig. 7, *b*) have the ends of the curved arms of the × -shaped central rod either simple or bipartite, in which latter case not four but eight holes are present; they have a diameter of 0·056 mm. The plates (Pl. V. fig. 7, *a*) overlap each other and form a continuous layer under the cups; they measure 0·6 mm. in diameter, and are usually provided with many holes. They have a very irregular form.

The species doubtless represents the Antarctic form of *Thyone raphanus*, but differs from it mainly by the absence of anal teeth.

Genus *Thyonidium*, Düben and Koren, 1844.

Thyonidium cebuense, Semper (Pl. IX. fig. 4).

Habitat.—Station 201, October 26, 1874; lat. 7° 3′ N., long. 121° 48′ E.; depth, 82 fathoms; stones and gravel; one specimen.

This specimen, which is 11 mm. long, is ovate and of a light yellowish-brown colour. The pedicels are comparatively long and their sucking-disks well marked; they seem to be disposed in five longitudinal series, but from the contracted state of the animal the arrangement is not very clear. The specimens examined by Semper have an arrangement of the pedicels in rows which is distinct only in the posterior extremity of the body, but it must be kept in mind that the Challenger specimen is younger, and that young forms are often characterised by having the pedicels more distinctly arranged in rows. I only counted nineteen tentacles. A single Polian vesicle and madreporic canal are present. The five interradial pieces of the calcareous ring (Pl. IX. fig. 4, *a*) are simple; each of the radial, on the contrary, consists of a larger main-piece and two posterior prolongations, each composed of two or three joints. Semper seems to have found only one kind of tables; in the Challenger specimen, however, I have observed, in addition to the small tables, large ones scattered among the former. The small tables (Pl. IX. fig. 4, *b*, *c*, *d*) have a rounded disk with the margin undulated and regularly perforated by eight peripheral holes and a slightly larger central hole; the diameter of the disks measures 0·08 mm. The spire of these tables, when fully developed, consists of four rods and one transverse beam, and terminates in about eight small teeth. Often, however, the spire is more or less incompletely developed. The larger tables (Pl. IX. fig. 4, *e*) have the disk more irregular and the spire mostly devoid of teeth; the disk measures 0·16 mm. in diameter or more. The pedicels are strengthened by deformed tables which have the disks elongate and rod-like, and the spire more or less irregular; their shape will be best understood from the figures (Pl. IX. fig. 4, *f*).

Since some small differences exist, and since, moreover, Semper's description of the calcareous deposits is very unsatisfactory, I cannot be fully convinced of the identity of the Challenger specimen with those examined by Semper.

Thyonidium rugosum, n. sp. (Pl. V. fig. 5).

Body tapered posteriorly into a conical caudal portion. Tentacles eighteen, five small pairs alternating with three pairs of large tentacles and two unpaired large ones. The smaller tentacles several times smaller than the larger. Pedicels very closely crowded, and distributed over the ambulacra as well as the interambulacra; no arrange-

ment in rows visible, excepting in the conical caudal portion, which is characterised by five double rows of light brownish pedicels, corresponding to the ambulacra. Only the ends of the pedicels are retractile, while the rest is hard, very rough, and more or less conical in shape. Perisome thick, hard, leathery, and very rough from numerous closely disposed, more or less overlapping tables composed of a mostly elongate or irregular fusiform, perforated disk and a long conical spire made up of two rods united towards the pointed top. The spire is especially long in the pedicels. Length of the contracted specimen about 35 mm. Colour in alcohol, brown with light pedicels and tentacles.

Habitat.—Station 167A, June 27, 1874; Queen Charlotte Sound, near Long Island; lat. 41° 4′ S., long. 174° 19′ E.; depth, 10 fathoms; mud; a single complete, contracted specimen, and caudal portions of numerous other specimens.

The only complete specimen I have had at my disposal is rather contracted, so that the pedicels appear more crowded than they really may be. Only the caudal portion seems to be devoid of pedicels on the interambulacra. The pedicels decrease in size towards the posterior extremity of the body, and they are uncommonly rough from the long spires of the tables. The anal aperture is surrounded by some small cylindrical papillæ, strengthened by reticulate plates without spires. The tentacles are retracted, their true position being difficult to determine. In conformity with the general condition in the genus *Thyonidium*, the tentacles are unequal and arranged in pairs, five pairs being several times smaller than the eight remaining tentacles, which are distributed as three pairs and two odd tentacles. Thus, these species deviate from the typical forms with twenty tentacles by the circumstance that two of the tentacles are unpaired.

The calcareous ring (Pl. V. fig. 5, *a*) is characterised by having its ten pieces composed of numerous small parts; the radial pieces are prolonged posteriorly and measure 25 to 30 mm. in length. The figure will give an idea of its construction. I only found a single madreporic canal and Polian vesicle. In consequence of the contracted state, the retractors are short but very thick; they seem to be attached at about the middle of the body. The respiratory organs are well developed.

The tables present themselves under very variable sizes and shapes, some being small and having a somewhat rounded or angular disk, others being elongate or fusiform, with a varying number of holes (Pl. V. fig. 5, *b* and *c*). The largest tables have a length of 0·50 mm. or more. The outwardly directed spires attain their greatest length, 0·16 mm. or more, in the pedicels. The spire is formed by two rods, united towards the elongated conical top, and separated at the base by a hole. At the ends of the pedicels the disks become more irregular and rod-like (Pl. V. fig. 5, *d*). The terminal plates of the pedicels appear to be rather incompletely developed.

Thyonidium rugosum is certainly nearly allied to *Thyonidium japonicum*, von Marenzeller.

Genus *Orcula*, Troschel, 1846 ; Semper, 1868.

(?) *Orcula hypsipyrga*, von Marenzeller, 1881 (Pl. V. fig. 6).

Habitat.—Station 233A, May 19, 1875 ; lat. 34° 38′ N., long. 135° 1′ E. (Japan) ; depth, 50 fathoms ; sand ; a single individual.

The specimen obtained by the Challenger Expedition has a length of about 120 mm., thus being much larger than the specimen described by von Marenzeller. The posterior extremity of the body is much more tapered than the anterior, and is destitute of any teeth. The colour in alcohol, is reddish or yellowish, brownish-grey, with the sucking-disks of the pedicels white. The pedicels are scattered all over the ambulacra and interambulacra, and do not present any arrangement in rows ; they are slightly more numerous on the ventral surface than on the dorsal. The perisome is thin and pliable, but its surface is rough from the outwardly directed spires of the tables. The tentacles are small and completely withdrawn into the body, and therefore I am not able exactly to state their number and position ; I counted only about thirteen tentacles. The five radial pieces of the calcareous ring (Pl. V. fig. 6, *a*) consist of several smaller parts and are prolonged posteriorly into two long processes, the narrow ends of which are joined to the corresponding ends of the adjacent pieces, exactly as stated by von Marenzeller. The interradial pieces are simple, without posterior prolongations. The length of the radial pieces is about 17 mm. A single madreporic canal and Polian vesicle are present. The retractors communicate with the longitudinal muscular bands near the anterior extremity of the body. The reproductive organs are well developed, and their tubes are about 20 mm. long, and slightly branched. The respiratory organs attain nearly the length of the body itself, and their branches are short and not very numerous.

Excepting the well-developed terminal plates of the pedicels, the perisome contains only calcareous tables (Pl. V. fig. 6, *b*) consisting of a more or less irregularly rounded, or even angular disk, with about twenty holes in it, and a spire composed of four, seldom more, rods, which are several times transversely connected. The spire is more or less conical, terminating in a single point or in several spines ; its length is about 0·14 mm.

To judge from the description of von Marenzeller, the tables in the type-specimen have more holes in the disk than is generally the case in those of the specimen brought home by the Challenger Expedition. No other difference seems to exist.

Genus *Phyllophorus*, Grube, 1840.

(?) *Phyllophorus incompertus*, n. sp. (Pl. V. fig. 8 ; Pl. VIII. fig. 5).

Body in contracted state ovate, about equally rounded at each extremity. Mouth closed by five prominences, each formed by three to six or more small papillæ with black retracted tops. Anus surrounded by very minute, almost inconspicuous

teeth. Pedicels distributed all over the body, slightly more crowded on the ventral surface. The ends of the pedicels black. Tentacles nineteen or twenty, unequal, completely retracted, and consequently their true position unknown. Perisome rather thick, leathery, flexible, with two kinds of deposits—in the exterior layer, tables with a very much reduced disk and a longer or shorter spire composed of two rods terminating in two or several points; and in the interior layer small, irregular, spinous × - or H-shaped bodies with one, two, or more holes. The tables are very often highly reduced, needle-like, with one end enlarged and pierced with a hole and with the opposite end pointed, or obtuse and spinous, or even bifurcate. Pedicels strengthened by well-developed terminal plates, and, besides, by some elongated, rod-like or fusiform perforated plates surrounding the terminal plate. Colour in alcohol, brown, lighter round the pedicels; ends of the pedicels black. Length of the largest specimen, 65 mm.

Habitat.—Port Jackson; depth, 6 to 7 fathoms; two specimens.

The tentacles being withdrawn inside the body in both specimens, I cannot distinguish their mutual position or decide whether they are arranged in one or two crowns. However, considering the great similarity of this species with Selenka's *Phyllophorus* (*Urodemas*) *perspicillum* in several important points, I propose to refer it to the genus in question. As far as I can see, no particular tentacles are less developed than the others, but larger and smaller alternate without order. The calcareous ring (Pl. V. fig. 8, *a*) is composed of ten simple pieces, each bifurcated posteriorly. Though the pieces are rather large, about 16 mm. long., they are flexible, spongy, and not firmly constructed. A strong membrane surrounds the ring exteriorly, communicating to it a cartilaginous appearance. Numerous madreporic canals and Polian vesicles surround the water-vascular ring. The retractors seem to be attached at about the middle of the body, and are united with the longitudinal muscular bands by a mesentery. The ampullæ of the pedicels are visible on the inside of the perisome. The genital tubes are short, thread-like, and slightly branched. The respiratory-trees are well developed. The different kinds of calcareous deposits (Pl. V. fig. 8, *b*) are figured, consequently no further description of them is necessary. The longest tables measure up to 0·12 mm. or more, and the × - or H-shaped spinous bodies (Pl. V. fig. 8, *c*) have a diameter of about 0·05 mm.

With regard to the deposits, the calcareous ring, the numerous madreporic canals and Polian vesicles, the species bears the nearest resemblance to Semper's *Cucumaria maculata*.

When comparing the above description with that of Selenka's *Phyllophorus perspicillum*, one finds an evident similarity in internal and external organisation, and, considering that the forms in question are obtained from the very same locality, there could not be any doubt about referring them to one and the same species, if Selenka's statement as to the shape of the deposits were not so different. Selenka does not mention anything about the tables and × - or H-shaped bodies, but he figures,

on the contrary, some spectacle-like rods, which bear the greatest resemblance to the deformed or undeveloped tables figured by me. Possibly the other deposits escaped the attention of Selenka, though it is not probable, considering that they are present in great number. The supposition that *Phyllophorus incompertus* is identical with Selenka's species is strengthened by the fact that in the State Museum of Stockholm one specimen from the same locality is preserved, which agrees with the above description.

SURVEY OF THE GENERA AND SPECIES, HITHERTO KNOWN, BELONGING TO THE DENDROCHIROTÆ.

Family III. Dendrochirotæ.

Tentacles dendriform. Retractor muscles present. Mouth and anus at opposite poles of the body.

Subfamily 1. Stichopoda.

Ambulacral appendages in the shape of pedicels alone, or pedicels together with papillæ, the latter often placed on larger or smaller processes; they are mostly arranged in rows, on the dorsal as well as the ventral ambulacra; interambulacra, with comparatively few exceptions, naked. Tentacles ten, rarely eighteen, twenty, or twenty-four. Calcareous ring of ten pieces, which usually are simple and devoid of prolongations posteriorly.

Genus 1. Cucumaria, Blainville, 1834.

Tentacles ten, rarely of equal size, two ventral commonly smaller. Ambulacral appendages almost without exception in the shape of pedicels forming one, two, or more rows along each ambulacrum. Seldom pedicels also on the interambulacra. Deposits highly variable, very seldom in the shape of reticulate scales.

A. Ambulacral Appendages—Pedicels alone.

I. Pedicels present only on the ambulacra.

1. *Pedicels, at least the ventral ones, arranged in more than two rows on each ambulacrum.*

Cucumaria godeffroyi, Semper, 1868.

Body acutely ovate. Pedicels in three to four rows in each ambulacrum, excepting at the extremities of the body, where only two rows are present. Deposits—irre-

gular plates with very uneven or spinous margins, with a few larger holes and with distinct spines on the exterior surface. Calcareous ring without posterior prolongations.

Habitat.—Iquique (Semper).

Cucumaria grubii, von Marenzeller, 1874. *Cladodactyla dicquemari*, Grube, 1840. *Cucumaria dicquemarii*, Sars, 1857.

Body fusiform. Pedicels of the ventral ambulacra in three to four rows, those of the dorsal ambulacra in two to three rows; towards the extremities of the body the pedicels form one or two zigzag rows. Deposits—numerous thick, oval or elliptic buttons with numerous conical knobs or spines and minute round holes; smaller scattered buttons with round knobs and no holes (=developmental stages); a very few minute rods or spicules (=undeveloped cups) in the exterior layer of the perisome.

Habitat.—Mediterranean Sea (Grube, Sars, v. Marenzeller, Ludwig).

Cucumaria maculata, Semper, 1868.

Body ovate. Ventral pedicels arranged in four to six rows in each ambulacrum, the dorsal ones in two to three rows. Radial pieces of the calcareous ring with two long posterior prolongations. Deposits—scattered massive tables with the small disk uneven or spinous in the margin and perforated with four central holes, and having the spire resembling a simple column with strong spines at the top. In the pedicels the spire of the tables becomes much longer and the disk deformed and reduced to a spherical network.

Habitat.—Bohol (Semper), Port Jackson (Bell).

Cucumaria crucifera, Semper, 1869.

Body swollen. Ventral pedicels in four to six rows in each ambulacrum; the dorsal ones in only two rows. Calcareous ring without posterior prolongations. Deposits—large buttons resembling those in the Aspidochirotæ; and cruciform more or less spinous bodies.

Habitat.—Aden (Semper).

According to the figures, given by Semper, minute incomplete rosettes may also be present in the integument.

Cucumaria glaberrima, Semper, 1869.

Body swollen. Ventral pedicels in six to eight rows in each ambulacrum; the dorsal ones in only two or three rows. Calcareous ring small and without posterior prolongations. Deposits—scattered thick disk-like plates with dentate margin and four small holes.

Habitat.—Aden (Semper), Berbera (Ludwig).

2. *Pedicels arranged in one or two rows on each ambulacrum.*

a. Deposits—roundish or oval buttons with a few perforations and often with large rounded knobs, besides minute reticulate cups.

Cucumaria quinquésemita, Selenka, 1867.

The cups are irregularly reticulate, with the spinous rim complete or incomplete. The oval buttons form a thick layer, are smooth and more or less swollen, always with four holes. Calcareous ring with slender posterior prolongations.

Habitat.—Mendocino in California and (?) Charleston (Selenka).

Cucumaria planci (*Cladodactyla*), Brandt, 1835; von Marenzeller, 1874. *Cucumis marinus*, Rondelet, 1555. *Echinus coriaceus ad os fimbriatus*, Plancus, 1760. *Holothuria pentacta*, Gmelin, 1788 (*partim*). *Holothuria doliolum*, Lamarck, 1816 (*partim*); Delle Chiaje, 1828. *Pentacta doliolum*, Jæger, 1833 (*partim*). *Cladodactyla doliolum*, Grube, 1840. *Cucumaria doliolum*, Sars, 1857; Selenka, 1867. (?) *Cucumaria cylindrica*, Semper, 1868.

Body cylindrical or slightly pentangular. The closely packed innumerable knobbed buttons are of unequal size, the larger having more holes and knobs than the smaller. The flat cups are numerous, minute, formed by three curved spokes and a rim with short processes. According to Selenka, three ventral pieces of the calcareous ring are united together.

Habitat.—West coast of France (Barrois), Arrabida (Greeff), Mediterranean Sea (Ludwig, Marion, v. Marenzeller, Sars, Grœffe, &c.) (?), Mauritius (Semper, Hoffmann).

Brady and Robertson (1871) described an animal, dredged in the Firth of Clyde, under the name of *Cucumaria pentactes*, which probably may be identical with this species or the next one, but unfortunately their description is too unsatisfactory to decide it. They do not mention anything about the "cups."

(Mus. Holm.) Two specimens dredged at Naples and one at Portoré, agreeing with the description of Sars, &c. The buttons often seem to have about eight holes and twelve to fifteen knobs, but they have not seldom fewer, or even more.

Cucumaria lactea (*Ocnus*), Forbes, 1841; Düben and Koren, 1844. *Holothuria badotriæ*, Dallyell, 1851.

Habitat.—British Islands (Hodge, Forbes, M'Intosh, Möbius and Bütschli, Leslie and Herdman); west coast of Norway at Bergen and Christiansund (Düben and Koren, Sars, Danielssen).

This species must be very nearly allied to the preceding one, differing from it mainly by the simple rows of pedicels.

(Mus. Holm.) Very numerous specimens from the west coast of Sweden and Norway.

Length of the largest individual, 35 mm. Pedicels in simple zigzag rows along the ambulacra. Two ventral tentacles smaller. Calcareous ring, like that in *Cucumaria hyndmanni* and *Cucumaria elongata*, devoid of posterior prolongations. Deposits—more or less regularly formed, knobbed, perforated buttons; and minute cups. The buttons are of a roundish form and unequal in size, in number of holes and knobs; commonly the rounded knobs are rather prominent. Some of the buttons are of considerable size, almost plate-like, with numerous holes and knobs. The cups are in want of a true rim, the ends of the dichotomously branched curved arms or spokes, which constitute the cups, being never, or only seldom, connected with each other. Pedicels supported by perforated rods of the shape figured by Düben and Koren. Colour, whitish.

b. Deposits—oval knobbed buttons with four holes and undulated margin; larger plate-like ones with at least one complete circlet of smaller holes round the four central ones, and with uneven or knobbed surfaces.

Cucumaria vicaria (Ocnus), Bell, 1883.

Pedicels in pairs, like the typical forms of this group of *Cucumaria*, but so irregular that they present a zigzag arrangement in each ambulacrum. Some of the deposits attain to a great size; the smaller are developmental stages of the larger. The pieces of the calcareous ring delicate, without posterior prolongations (?).

Habitat.—Antarctic Sea (Bell).

c. Deposits—slightly irregular, oval or oblong buttons, with a smaller number of holes, with knobs or spines, and with one end drawn out into a considerable spine or dentate perforated process.

Cucumaria leonina, Semper, 1868.

Body ovate. No anal teeth. The oblong buttons have, according to the figure given by Semper, about seven holes, two smaller of which are situated in the narrower dentate end. Even the knobs seem to be few, though about twice as many as the holes. Calcareous ring devoid of posterior prolongations (?).

Habitat.—Singapore (Semper).

Cucumaria miniata (*Cladodactyla*, subgenus *Polyclados*), Brandt, 1835; Selenka, 1867; Ludwig, 1881. *Pentacta miniata*, Stimpson, 1857. (?) *Cucumaria albida*, Selenka, 1867. *Cucumaria fallax*, Ludwig, 1875.

Body cylindrical. Anus surrounded by five small radially disposed plates or teeth. Calcareous ring not very well developed, without posterior prolongations (?). Deposits like those in *Cucumaria leonina*.

Habitat.—Alaska (Ludwig), Sitka (Brandt), California (Selenka).

Cucumaria echinata, von Marenzeller, 1881.

Body ovate. Radial pieces of the calcareous ring with two very short, obtuse prolongations. Buttons with rounded knobs, about eight holes, and with one end drawn out into a long, slightly outwardly-directed, simple spine.

Habitat.—Japan or China (v. Marenzeller).

d. Deposits in the shape of tables alone, or tables together with plates.

Cucumaria populifer (*Pentacta*), Stimpson, 1864. (?) *Cladodactyla* (*Holigoclados*) *albida*, Brandt, 1835. (?) *Cucumaria albida*, Ludwig, 1881.

Body thick, fusiform, "covered with minute, perforated polygonal plates, each plate having from twenty-five to forty holes, and being armed with a sharp umbo or spine at the centre of its outward surface."

Habitat.—Sitka (Brandt), Puget Sound (Stimpson).

These plates of Stimpson may probably be referred to tables, the central spine being a reduced spire. Calcareous ring unknown.

Cucumaria calcigera (*Pentacta*), Stimpson, 1854; Selenka, 1867; Duncan and Sladen, 1881. (?) *Cucumaria hyndmanni*, Forbes, 1852. *Cucumaria korenii*, Lütken, 1857.

In the middle of the curved, posteriorly-tapering body, the pedicels lie more closely crowded, so as to form four rows. Integument thin, but rough and rather hard from very closely crowded deposits forming two layers; those in the inner layer being more oblong and narrow plates, generally pierced with two or three rows of holes; those in the outer being tables, consisting of an irregularly rounded, oblong or stellate disk perforated with more or less approximated holes, from the centre of which an elevation rises made up of fine rods, and terminating in spines or teeth. Calcareous ring with long posterior prolongations.

Habitat.—Greenland (Lütken, Duncan and Sladen, Ludwig, Norman), Wellington Channel (Forbes), Labrador (Verrill), Massachusetts (Stimpson), Nova Zembla and Sea of Kara (Stuxberg).

(Mus. Holm.) A great number of specimens dredged at Nova Zembla and several localities off Greenland. The largest measures up to 120 mm. in length, the smallest about 6 mm. Body always curved and tapering posteriorly into a caudal portion, while the anterior extremity is more truncated. The disks of the tables seem to be comparatively large, and the spire is generally of a more irregular shape, in consequence of which it is difficult to get any information as to its true shape; sometimes the spire seems to be built up of only two rods and one transverse beam, but it is mostly composed of several rods, and terminates in several spines. The underlying irregularly shaped plates sometimes seem to bear one or a few minute knobs or elevations near their centre. In the

pedicels the tables commonly have an elongated disk supporting a more or less rudimentary spinous spire. No true supporting rods seem to be present in the pedicels.

Cucumaria citrea, Semper, 1868.

Body pentangular, with numerous pedicels along the angles. Deposits—plates and tables; the former small, rectangular, with a few holes, the two central of which are often larger; the latter consisting of a disk, mostly pierced with only four large holes, and a spire made up of two rods or legs, which are not connected by transverse beams. Each of the ten portions of the calcareous ring composed of numerous small pieces; the five radial portions with two slender posterior prolongations.

Habitat.—Bohol (Semper).

Semper does not mention anything about the arrangement of the pedicels in each ambulacrum, whether they form two or more rows, wherefore I am not sure whether this species belongs to this group of Cucumaria. Besides the two kinds of deposits mentioned above, Semper figures a small calcareous body resembling an undeveloped rosette.

e. Deposits—irregular spinous rods or spicules.

Cucumaria nigricans (*Cladodactyla*, *Polyclados*), Brandt, 1835; Selenka, 1867; Ludwig, 1881. *Pentacta nigricans*, Stimpson, 1857. (?) *Pentacta piperata*, Stimpson, 1864.

Body elongated, ovate. The calcareous rods only present in the bivium. Pedicels devoid of terminal plates. No calcareous ring.

Habitat.—Sitka (Brandt, Ludwig), (?) Puget Sound (Stimpson).

f. Deposits—reticulate spherical bodies, ellipses or cups alone or together with scales.

Cucumaria semperi, Bell, 1884.

Body pentangular. Deposits—spherical bodies alone, made up of a central four-armed spicule, an oval smooth rim, thus constituting four larger holes, and one beam crossing the bodies at the middle. Supporting rods of the pedicels resembling folding eye-glasses. Calcareous ring, as in *Cucumaria citrea*, composed of a number of pieces.

Habitat.—Port Denison and Torres Strait (Bell).

To judge from the figure drawn by Bell, the deposits may be like oval "cups," pierced with four holes, and with the opening crossed by a beam; but these "cups" are somewhat different from those common in several species of Cucumaria.

Cucumaria chronhjelmi, n. sp.

Body indistinctly pentangular. Pedicels numerous, cylindrical, long, forming apparently a double row along each ambulacrum; at the middle of the body they seem to be more crowded, there being three to four rows, but this is probably a result of the contracted state of the body. Tentacles ten, two ventral smaller. Anus with small teeth. Polian vesicle and madreporic canal single. Calcareous ring very fragile, the interradial pieces being conical, pointed anteriorly; the radial obtuse, furrowed anteriorly and terminating posteriorly in two very slender prolongations. Deposits crowded, of two kinds; in the external layer of the perisome small reticulated spheres or globular cups; in the internal layer numerous hollow fenestrated ellipses of different size and shape, some being of a more elongated form, others more rounded, globular, and some being several times larger than the rest; among the larger ellipses are found here and there rather large scale-like bodies, composed apparently of a network of several superposed layers. Undeveloped ellipses, consisting of a small oval concave plate with four holes, may also be found. The pedicels have, round the large terminal plate, some irregular perforated plates, and, besides, numerous elongated rods with four holes at the slightly enlarged middle and a row of holes along each arm; the middle of the rods usually carries a kind of low conical, rounded spire. Length of the largest specimen, 55 mm. Colour, whitish.

(Mus. Holm.) Some specimens dredged at Vancouver's Island.

Cucumaria glacialis, Ljungman, 1879. *Cucumaria minuta*, Stuxberg, 1878.

Pedicels in simple rows towards the extremities of the body. Deposits—large, thick, reticulate, roundish or angular scales; and small undeveloped cups consisting of a cruciform body with the ends of the curved arms provided with three processes.

Habitat.—Spitzbergen (Ljungman), Nova Zembla (Stuxberg).

(Mus. Holm.) Numerous type-specimens obtained at Spitzbergen and Nova Zembla. At the middle of the body the pedicels are placed in double alternating rows. The calcareous scales, visible to the naked eye, are more or less close together, and built up of several (two or three) superposed reticulate layers so as to constitute solid reticulate bodies. The cups, which are rather solid, are devoid of rim because of the four (seldom three or five) curved arms not being united at their free outwardly directed ends. Calcareous ring very slender, devoid of posterior prolongations. Polian vesicle and madreporic canal single. There seems to be reason for believing this species to be identical with Fabricii's *Ocnus minutus*.

h. Deposits—more or less irregular, simple, smooth, perforated plates, together with reticulate cups or spheres.

Cucumaria elongata, Düben and Koren, 1844; Sars, 1857. (?) *Holothuria pentactes*, Linné, 1767, and O. F. Müller, 1788–1789. *Cucumaria pentactes*, Forbes, 1841; v. Marenzeller, 1874; Ludwig, 1879. (?) *Hydra corallifera*, Gærtner, 1762. *Holothuria dicquemarii*, Cuvier, 1817. *Holothuria gærtneri*, Jæger, 1833. *Cucumaria fusiformis*, Forbes, 1841 (according to Norman, 1868). *Holothuria montaguii*, Fleming, 1828. (?) *Holothuria fusus*, Rathke, 1843.

Body more or less distinctly pentangular, slender, decreasing posteriorly into a long narrower caudal portion. Pedicels forming a double row only at the middle of the body; towards the extremities they form a simple zig-zag row. Body-wall hard from closely placed large, smooth, oblong, sometimes irregularly rounded, perforated plates with numerous holes. The cups are built up of four curved spokes and a spinous rim.

Habitat.—West coast of Scandinavia northwards to Christiansund (Düben and Koren, Danielssen, Möbius, Lütken, Sars, Ludwig), (?) White Sea (Jarzynsky), British Islands (Forbes, Pennant, Montagu, Alder, Hodge, Norman, M'Intosh, Leslie and Herdman, Möbius and Bütschli), Holland (Möbius and Bütschli), France (Fischer), North of Spain (Fischer), Mediterranean Sea (Sars, v. Marenzeller, Ludwig).

(Mus. Holm.) A great number of specimens from the west coast of Sweden and two specimens dredged at Bay of Muggia. Calcareous ring, like that in *Cucumaria hyndmanni*, devoid of posterior prolongations, but its posterior contour is distinctly undulated.

The "Porcupine" Expedition brought home one individual from Station 10, 1870, dredged at a depth of 81 fathoms.

Cucumaria tergestina, Sars, 1857.

Body fusiform, more or less pentangular, slightly curved and more tapered posteriorly. Pedicels conical, hard, not retractile, arranged in five double rows. Body-wall hard from numerous long and narrow, rectangular, perforated plates. The cups consist of four, seldom five, curved spokes and a spinous rim.

Habitat.—Mediterranean Sea (Sars, Marion, Ludwig, Greeff, &c.).

This species is nearly related to the preceding one, but differs mainly in the thicker body, in the stiff conical pedicels and their arrangement in double rows all along the ambulacra, and in the much narrower and longer plates, &c.

(Mus. Holm.) Two specimens obtained at the Bay of Muggia.

"Porcupine" Expedition.—One specimen dredged at Station 31, 1870, at a depth of 177 fathoms. The body of this individual is curved, much more tapered posteriorly, so as to form a kind of narrower caudal portion. The conical, stiff, non-retractile pedicels form an alternating double row along each ambulacrum. Colour, light greyish or yellowish-brown. Body-wall hard, inflexible, with

numerous deposits. The plates are much elongated, several times longer than broad, quite smooth, with numerous holes, which in some narrower plates almost form two longitudinal rows. Calcareous ring of usual form without posterior prolongations.

Cucumaria cucumis (*Holothuria*), Risso, 1826; Sars, 1857; von Marenzeller, 1874.
Cucumaria pentactes, Selenka, 1867.

Body almost like that in *Cucumaria elongata*. The plates are irregularly rounded or oval, several times smaller than those in *Cucumaria tergestina*, very seldom of a more elongated form; often two holes are larger than the rest. The numerous almost spherical, reticulate cups are of a more irregular shape, so that an arrangement of radial spokes becomes invisible or very indistinct. Calcareous ring of usual form without posterior prolongations.

Habitat.—Mediterranean Sea (Sars, v. Marenzeller, Heller, Ludwig, Greeff, &c.).

(Mus. Holm.) Two specimens dredged at Bay of Muggia. When comparing specimens of this species with equally large ones of *Cucumaria elongata*, it will be found that the caudal portion is not so narrow, and that the pedicels form a distinct double row all along each ambulacrum. Three kinds of deposits are present; comparatively small, irregularly rounded, smooth plates, commonly of a more undecided shape, with a smaller number of holes, two of which are often slightly larger; large elongated smooth plates with numerous holes, resembling those in *Cucumaria elongata;* and minute reticulate cups built up of an irregular network. Colour, blackish-brown with light pedicels. The species is doubtless very nearly allied to *Cucumaria elongata*, in which species I also found small roundish plates, though not in such great numbers.

Cucumaria improvisa, Ludwig, 1875.

Body indistinctly pentangular, tapered posteriorly. Integument thin. Deposits—closely placed, irregular, oblong, perforated plates; and small reticulate cups built up of about four curved spokes and a spinous rim. Calcareous ring devoid of posterior prolongations.

Habitat.—Algoa Bay (Ludwig).

Probably this form of Ludwig's is not a distinct species; it resembles in most respects *Cucumaria elongata*.

Cucumaria ignava, Ludwig, 1875.

Body indistinctly pentangular, posteriorly narrowed, anteriorly prolonged into five points. Integument hard, from numerous plates and reticulate spheres. Anus with small teeth. Calcareous ring devoid of posterior prolongations.

Habitat.—Gulf of St. Vincent (Ludwig).

Ludwig does not describe nor figure the calcareous plates, consequently their true shape remains unknown.

i. Deposits—irregularly formed, perforated simple plates alone, seldom together with small rosettes or rods; sometimes the plates are rod-like but with holes.

α. Calcareous ring well developed, with posterior prolongations.

Cucumaria africana, Semper, 1868.

Body nearly cylindrical. Radial pieces of the calcareous ring composed of a main part and two separate posterior prolongations. Deposits—large plates with short spines.

Habitat.—Querimba (Semper), Mauritius (Haacke, Ludwig).

β. Calcareous ring well developed, but devoid of posterior prolongations.[1]

Cucumaria hyndmanni (*Holothuria*), Thompson, 1840; Forbes, 1841; Düben and Koren, 1845; v. Marenzeller, 1874.

Body subcylindrical, slightly tapered posteriorly. Deposits—thick, nearly smooth perforated plates, all alike. Terminal plate of the pedicels incompletely developed or rudimentary; supporting rods pierced with one hole (or more) at the middle, and one at each end.

Habitat.—West coast of Scandinavia, south of the Arctic circle (Düben and Koren, Danielssen, Sars, Möbius, Storm, Ludwig), British Islands (Forbes, Norman, M'Intosh, Herdman, Thompson), Mediterranean Sea (Grube, v. Marenzeller, &c.).

(Mus. Holm.) Numerous specimens dredged off the west coast of Sweden. The crowded, perforated plates are of an irregularly rounded form, smooth, thick, solid, and swollen in appearance; among these are found some thinner and more finely constructed ones. Often the plates are slightly elongated or oval, with one end slightly narrower, bent obliquely outwards from the body of the animal, and rough from some minute spines or elevations. The numerous rods of the pedicels bear at the middle a short third arm, reminding one of a kind of spire. A single Polian vesicle and madreporic canal. Calcareous ring devoid of posterior prolongations.

"Porcupine" Expedition.—A few specimens dredged at Station 23, July 2, 1869, at a depth of 420 fathoms.

Cucumaria exigua, Ludwig, 1875.

Body cylindrical. Ventral pedicels more numerous than the dorsal. Deposits—large internal, and smaller external smooth perforated plates. Pedicels with rudimentary terminal plate, × -shaped bodies and large perforated supporting rods.

Habitat.—China Sea and Chili (Ludwig).

[1] In *Cucumaria frauenfeldi* and *Cucumaria kirchsbergii* the calcareous ring is unknown.

Cucumaria tenuis, Ludwig, 1875.

Body ovate. Interambulacra almost destitute of deposits. Ambulacra (including pedicels) with irregular spinous, perforated plates and spinous rods, the latter more frequent than the former; also terminal plates in the pedicels.

Habitat.—Celebes (Ludwig).

Cucumaria frauenfeldi, Ludwig, 1882. *Cucumaria*, n. sp., Semper, 1868.

According to Semper, this species is nearly related to *Cucumaria frondosa*. Deposits—rather numerous, in the shape of spectacles, viz., rods with a hole in each enlarged end.

Habitat.—Java (Semper), Cape of Good Hope (Ludwig).

The description is very incomplete.

Cucumaria kirchsbergii, Heller, 1868. *Ocnus* (?) (*Cucumaria*) *kirchsbergii*, von Marenzeller, 1874.

Body ovate. Deposits—numerous oblong plates with slightly uneven surface, with one end produced into a narrow dentate process and mostly with two rows of holes; also, according to von Marenzeller, small rosettes. Pedicels with terminal plates and supporting rods almost resembling those in *Cucumaria hyndmanni*, to which the species seems to bear the greatest resemblance.

Habitat.—Mediterranean Sea (Heller, von Marenzeller).

Cucumaria californica, Semper, 1868. (?) *Pentacta frondosa*, Ayres, 1855, and Stimpson, 1857.

Body ovate, like that in *Cucumaria frondosa*. Deposits—large smooth plates with a comparatively small number of holes. Pedicels devoid of terminal plates, but with a few three-armed, perforated supporting rods.

Habitat.—Mazatlan in California (Semper).

Semper says that one cannot distinguish this species from *Cucumaria frondosa* without the most careful anatomical examination, wherefore I am somewhat uncertain whether the dorsal interambulacra are naked or carry some scattered pedicels or whether the tentacles are equal, as in the species mentioned. Possibly the species is only a young form of *Cucumaria frondosa*.

γ. *Calcareous ring in a low stage of development.*

Cucumaria lævigata (*Pentactella*), Verrill, 1876; Studer, 1877 and 1879; Smith, 1879.

Tentacles nearly equal. Pedicels of the dorsal and ventral surfaces nearly equally large.

Habitat.—Kerguelen Islands (Verrill, Studer, &c.).

An Antarctic form of *Cucumaria frondosa*. Compare the above description.

Cucumaria crocea (*Holothuria*), Lesson, 1830; Selenka, 1867. *Pentacta crocea*, Jæger, 1833. *Cladolactyla* (*Polycladus*) *lessonii*, Brandt, 1835. *Cladodactyla crocea*, Wyville Thomson, 1877 and 1878.

Tentacles typical, two ventral smaller. Dorsal pedicels more numerous and several times smaller than the ventral.

Habitat.—Falkland Islands (Lesson, Thomson).

Allied to *Cucumaria frondosa*. Compare the above description.

Cucumaria japonica, Semper, 1868.

Calcareous ring almost absent, only traces of radial pieces being left. Deposits—irregular, perforated plates with fine knobs or spines; larger plates near the anal aperture.

Habitat.—Japan (Semper).

Even with regard to this species, the arrangement of the dorsal pedicels and the size of the tentacles are not fully clear. Semper states that it is closely allied to *Cucumaria frondosa*.

II. Pedicels present in the ambulacra, and also scattered all over the interambulacra or over some of them.

1. *Pedicels arranged in double rows along the five ambulacra; besides, scattered ones on the dorsal interambulacra, whereby the dorsal rows become more or less indistinct.*

Cucumaria frondosa (*Holothuria*), Gunnerus, 1767; Forbes, 1841; Duncan and Sladen, 1881. *Holothuria pentactes*, O. F. Müller, 1806. *Pentacta frondosa*, Jæger, 1833. *Cuvieria frondosa*, Blainville, 1834. (?) *Cladodactyla pentactes*, Brandt, 1835. (?) *Cucumaria fucicola*, Forbes, 1841. *Botryodactyla grandis*, Ayres, 1854 and 1873. *Botryodactyla affinis*, Ayres, 1854.

Body ovate. Tentacles nearly equal. A quadruple disposition of the pedicels in the middle of the ambulacra common in old individuals; a few pedicels scattered over the dorsal interambulacra. Deposits—irregular smooth simple perforated plates. Some specimens, especially the larger, are almost devoid of deposits, while others are more or less richly provided with plates. Generally the plates are more frequent in, or in the neighbourhood of the ambulacra. Calcareous ring not very well developed.

Habitat.—Greenland (Lütken, Norman, Duncan and Sladen, Ludwig, Stimpson, &c.). Spitzbergen (Lütken, Ljungman), Thousand Islands in the Arctic Sea (Heuglin), off Beeren Island (Danielssen and Koren), Iceland (Lütken, Ludwig), west coast of Scandinavia from Finmark to Kattegat (Düben and Koren, M'Andrew

and Barrett, Danielssen, Sars), White Sea (Jarzynsky), British Islands (Forbes, M'Intosh, Leslie and Herdman, Ludwig, Norman), north and east coasts of North America southwards to Cape Cod (Forbes, Duncan and Sladen, Verrill, Ayres, Stimpson, Ludwig, Lütken), east coast of North America south of Cape Cod at Florida Reef (Pourtalès), west coast of North America at Gulf of Georgia (Selenka), and California (Ayres).

(Mus. Holm.) A very great number of specimens in different stages of development, brought home from North America, Greenland, Iceland, Spitzberg, Norway.

In old individuals the dorsal pedicels, being spread out over the adjacent parts of the three interambulacra—sometimes over the whole odd interambulacrum—do not present any well-marked double rows as do the ventral pedicels. The irregularly formed plates with uneven or spinous margins seem, as a rule, to be rare in the old specimens, and usually I only found them in the pedicels or in their neighbourhood. Calcareous ring slender, pliable, spongy, and in a comparatively low stage of development, without posterior prolongations. In small individuals the pedicels are, on the contrary, very obviously confined to the ambulacra even on the dorsal surface, and only a very few scattered ones may be found on the dorsal interambulacra. Often in such small forms the plates are more common in the dorsal perisome, while they are rare or totally absent in the ventral. In very small specimens the dorsal pedicels are fewer and smaller than the ventral, and only placed on the ambulacra.

"Porcupine" Expedition.—Two specimens dredged at Station 13; lat. 40° 16′ N., long. 9° 37′ W.; depth, 220 fathoms.

Cucumaria frondosa, var. *mediterranea*, Semper, 1868.

Habitat.—(?) Mediterranean Sea (Semper).

Differs from the type in its madreporic tubercle being much larger and in having two Polian vesicles.

Cucumaria dubiosa, Semper, 1868.

Body cylindrical. Tentacles nearly equal. Deposits—large roundish knobbed buttons with a few (four) holes; and more elongated ones with slightly more knobs and holes, and with one end drawn out, dentate and perforate. Calcareous ring unknown.

Habitat.—Peru (Semper).

Cucumaria parva, Ludwig, 1875.

Body cylindrical, tapering posteriorly. Tentacles typical. Calcareous ring devoid of posterior prolongations. Deposits—large perforated (smooth ?) plates and small × -shaped bodies. Dorsal pedicels irregularly dispersed so that no rows are traceable.

Habitat.—Chili (Ludwig).

Cucumaria canescens, Semper, 1868.

Body elongated, slightly swollen at the middle. Radial pieces of the calcareous ring with two long posterior prolongations. Body-wall thick. Deposits—tables consisting of an elliptical disk with eight or nine ovate swellings round the margin, and with a strong central spire formed by two rods; opposite to the spire is a roundish knob. In the internal layer of the perisome a simple knob is substituted for the spire, the deposits thus presenting the appearance of buttons.

Habitat.—Bohol, Pandanon (Semper).

2. *Pedicels in two or three rows along each ambulacrum; also more or less closely scattered ones on the two ventral interambulacra, the arrangement in rows being there more or less indistinct.*

Cucumaria longipeda, Semper, 1868.

Body pentangular, tapering posteriorly and anteriorly. Pedicels very long, in two or three rows along each ambulacrum, and, besides, a few on the two ventral interambulacra. Deposits—tables consisting of a roundish perforated disk and a spire composed of four rods, and one transverse beam. Radial pieces of the calcareous ring composed of a main part and two narrow separate posterior prolongations, each made up of two joints.

Habitat.—Bohol, Pandanon (Semper).

Cucumaria conjungens, Semper, 1868.

Body cylindrical, rounded anteriorly, tapered posteriorly. Ventral pedicels numerous, irregularly dispersed over the ambulacra and interambulacra; dorsal pedicels only confined to the ambulacra, where they form two to three rows. Radial and interradial pieces of the calcareous ring composed of several smaller parts, the former with two long articulate posterior prolongations. Deposits—tables, resembling buttons, with an oval knobbed disk perforated by a few (four) holes, and with a very short spire with two points.

Habitat.—Mariveles, Bay of Manilla (Semper).

3. *Pedicels in a double row along the ambulacra, and also scattered ones on both dorsal and ventral interambulacra.*

Cucumaria köllikeri, Semper, 1868.

Body ascidiform. Tentacles of equal size. Interambulacral pedicels smaller than the ambulacral. Deposits—roundish knobbed buttons with a few holes; and more

elongated ones with one end drawn out, perforated and dentate. Calcareous ring devoid of posterior prolongations.

Habitat.—Mediterranean Sea (Semper and Ludwig).

The species bears the greatest resemblance to *Cucumaria dubiosa*, from which, however, it differs not only in the arrangement of the pedicels, but also in the absence of any muscular stomach.

Cucumaria salmini, Ludwig, 1875.

Body tapering posteriorly and anus dentate. Tentacles of not quite equal size. Dorsal interambulacral pedicels more abundant than the ventral. Deposits and calcareous ring like those in *Cucumaria köllikeri*.

Habitat.—Celebes (Ludwig).

This form and the preceding must be closely allied, and possibly represent varieties of one and the same species.

Cucumaria syracusana (*Cladodactyla*), Grubè, 1840; Sars, 1857.

Body ovate, with the pedicels very small. Deposits—numerous thick round or oval buttons, with numerous round holes and roundish or conical knobs; numerous crowded smaller roundish buttons with a few holes and knobs; numerous minute incomplete cups, made up of three-, seldom four-armed spicules, with the ends of the curved arms parted in two or more branches. Calcareous ring unknown.

Habitat.—Mediterranean Sea (Grube, Sars, Heller, v. Marenzeller, Ludwig), Calabar, off the west coast of Africa (Ludwig).

(Mus. Holm.). One specimen, dredged at Cagliari, of a dark brownish colour, almost black or inclining to violet. Deposits fully agreeing with those described and figured by Sars. The large buttons are more scattered, of a rounded ovate form, very thick, with one end slightly narrower, and with numerous small holes and large knobs, the knobs being either conical or rounded, excepting at the narrower end of the buttons, where they are conical and pointed. The small buttons have generally four holes and a smaller number of large rounded knobs. Five small individuals, obtained from the same locality, differ somewhat from the typical ones, in that the large buttons are more irregularly plate-like, not so thick, and have often one end drawn out into a very distinct, narrow, spinous portion, thus reminding one of the deposits in *Cucumaria köllikeri*.

Cucumaria punctata, Ludwig, 1875.

Body cylindrical. The double rows of pedicels less distinct at the middle of the body in consequence of the numerous interambulacral pedicels. Deposits—knobbed buttons, and perforated cups, built up of four curved spokes and a spinous rim. Calcareous ring devoid of posterior prolongations.

Habitat.—Barbados (Ludwig).

Cucumaria nobilis, Ludwig, 1875.

Body swollen. Dorsal interambulacral pedicels more frequent than the ventral which are very rare. Deposits—tables, made up of a roundish, irregular, perforated disk, and a short spire composed of two to four rods. Calcareous ring devoid of posterior prolongations.

Habitat.—Off Norway (Ludwig).

Cucumaria vegæ, n. sp.

Body more or less obviously curved, tapering nearly equally towards each extremity. Tentacles ten, two ventral smaller. Anus with five teeth, made up of a calcareous network. Pedicels in a distinct double row on each of the ventral ambulacra and in a less distinct double row on the two dorsal; smaller pedicels are also to be found scattered over the five interambulacra of the larger specimen, while in the smaller individuals the ventral interambulacra seem to be almost naked. A single Polian vesicle and madreporic canal present. Calcareous ring very slender, devoid of posterior prolongations. Deposits more thinly scattered, of two kinds; smooth rods, typically with a hole in each slightly enlarged end, thus resembling spectacles, but often of a more irregular form, more or less curved, with several, often three, holes placed at each end; and here and there smooth plates with uneven, undulating margin, and pierced with a varying number of round holes. The surfaces of the plates and rods are not quite level, owing to some very low, nearly inconspicuous elevations. Pedicels with a very fragmentary terminal plate or none at all, but devoid of any other supporting rods than such as are found in the body-wall itself. Length of the largest specimen, 38 mm. Colour in alcohol; dorsal surface and the ends of the body dirty brown; ventral surface yellowish-grey. Possibly this species may be nearly allied to *Cucumaria nigricans*.

Habitat.—Behring Island (Mus. Holm.).

Cucumaria perspicua, Ludwig, 1875.

Body swollen. Pedicels much more numerous in the ventral ambulacra than in the dorsal, but, on the other hand, less numerous in the ventral interambulacra than in the dorsal. Excepting terminal plates in the pedicels, no deposits. Calcareous ring without posterior prolongations.

Habitat.—Off Norway (Ludwig).

B. Ambulacral Appendages—Pedicels and Conical Papillæ.

Cucumaria versicolor, Semper, 1868.

Body pentangular. Pedicels in five distinct series along the ambulacra, the narrow interambulacra being naked. Among the dorsal pedicels, conical ambulacral papillæ may be found. Radial pieces of the calcareous ring with two shorter

posterior prolongations. Deposits—tables with large irregularly perforated disks and a long central spire formed by two rods; and minute, irregular, dichotomously branched bodies or rosettes.

Habitat.—Bohol (Semper).

The following forms of Cucumaria are very unsatisfactorily known, a re-examination of them being necessary.

Cucumaria minuta (*Holothuria*), Fabricius, 1780; Blainville, 1834. *Pentacta minuta*, Jæger, 1833. *Dactylota minuta*, Brandt, 1835. (?) *Psolinus brevis*, Forbes, 1841; (?) Kowalevsky, 1867. *Ocnus ayresii*, Stimpson, 1853. *Ocnus minutus*, Semper, 1868.

Habitat.—Greenland (Fabricius, Lütken, Norman), north-east coast of North America, Grand Manan (Stimpson), British Islands, Færöe Islands, and Shetland Islands (Lütken, Forbes, Norman), Spitzbergen (Danielssen and Koren), (?) Mediterranean Sea (Kowalevsky).

Pedicels placed in simple or zigzag rows along the ambulacra, six to ten in each row; according to Lutken, fifteen pedicels in each ventral series and only a few in the two dorsal rows. Judging from the descriptions of Lütken and Stimpson, I am inclined to believe this species to be more nearly related to *Cucumaria lactea* or *planci* than to *Cucumaria frondosa*.

Cucumaria assimilis, Düben and Koren, 1844. *Pentacta assimilis*, Verrill, 1873.

Habitat.—Christiansund in Norway (Düben and Koren), coast of New England (Verrill).

Apparently resembling *Cucumaria lactea* of Forbes, in all respects, excepting that its deposits seem to be less closely crowded, but, on the contrary, more regularly formed. It is doubtless not a distinct species.

Cucumaria pusilla (*Holothuria*), Sars, 1828.

Habitat.—Norway, at Bergen (Sars).

Probably synonymous with *Cucumaria lactea* or one of its nearer relatives.

Cucumaria brunnea (*Holothuria*), Thompson, 1840. *Ocnus brunneus*, Forbes, 1841.

Habitat.—British Islands (Forbes, Thompson, Herdman).

A very dubious species, which seems to deviate from *Cucumaria lactea* and *Cucumaria assimilis* only by its brown colour.

Cucumaria lefevrii, Barrois, 1882.

Habitat.—West coast of France (Barrois).

Though there seem to exist some small differences between this form and some of the preceding ones, it may, nevertheless, be a very dubious species. According to

the researches of Barrois, it must closely resemble *Cucumaria planci*, but is said to have the calcareous ring composed of eight pieces and the cups built up of four curved spokes. Selenka has already pointed out that the three ventral pieces of the calcareous ring are united in *Cucumaria planci;* the cups in the latter species seem, however, to be usually formed of only three spokes.

Cucumaria panamensis (*Pentacta*), Verrill, 1867–1871.

Habitat.—Panama (Verrill).

Belongs to that group of *Cucumaria* which has the pedicels in double rows along the ambulacra alone. Skin filled with very numerous, minute calcareous grains or plates, but Verrill does not explain more exactly the shape of these deposits.

Cucumaria decollata (*Holothuria*), Gray, 1848. *Cucumaria montagui*, Bell, 1883.

Habitat.—British Islands.

Cucumaria neillii (*Holothuria*), Fleming, 1828; Leslie and Herdman, 1881.

Habitat.—British Islands.

Cucumaria dissimilis (*Holothuria*), Fleming, 1828; Leslie and Herdman, 1881.

Habitat.—British Islands.

(?) *Cucumaria planciana* (*Pentacta*), Delle Chiaje, 1841.

Habitat.—Mediterranean Sea.

(?) *Cucumaria ventactes* (*Pentacta*), Delle Chiaje, 1841.

Habitat.—Mediterranean Sea.

(?) *Cucumaria cucumis* (*Pentacta*), Delle Chiaje, 1841.

Habitat.—Mediterranean Sea.

(?) *Cucumaria tetraquetra* (*Holothuria*), Delle Chiaje, 1828. *Pentacta tetraquetra*, Delle Chiaje, 1841.

Habitat.—Mediterranean Sea.

Cucumaria saxicola, Brady and Robertson, 1871.

Habitat.—British Islands. As to the deposits, allied to *Cucumaria elongata.*

(?) *Cucumaria pusillus* (*Psolinus*), Norman, 1864.

Habitat.—British Islands (Norman).

Cucumaria thomsoni, Hutton, 1879.

Habitat.—Stewart Island, New Zealand (Hutton).

(?) *Cucumaria turbinata* (*Labidodesmus*), Hutton, 1879.

Habitat.—Stewart Island, New Zealand (Hutton).

Pentacta kowalevskii, Jarzynsky, 1885.

Habitat.—White Sea (Jarzynsky).

Genus 2. Ocnus, Forbes, 1841.

Tentacles ten, two ventral smaller. Ambulacral appendages—pedicels forming a simple row along each of the ambulacra, or, at least, along the dorsal and lateral ventral ones. Interambulacra, with a single exception, naked. Calcareous ring composed of ten simple pieces. Body usually distinctly pentangular, narrow, and the body-wall typically hard from crowded reticulate calcareous scales, or from a network almost forming a hard shell.

It seems impossible, for the present, to draw a line of demarcation between the genera *Ocnus* and *Cucumaria*. In several forms referred to *Ocnus*, the pedicels do not form simple rows, but are arranged in more or less distinct zigzags, which are really nothing but alternating double rows. Considering that *Ocnus vicarius, minutus, lacteus, brunneus*, and *assimilis* do not present any other distinctions, they may, without hesitation, be referred to the genus *Cucumaria*, the more so as they present in their general appearance the true *Cucumaria*-type. On the other hand, Semper mentions in his beautiful monograph another distinction which seems to be of more value. Thus, those forms should be considered as true representatives of the genus *Ocnus*, which were characterised by the possession of calcareous scales in the perisome like those known in the genus *Psolus*. *Ocnus molpadioides, pygmæus*, and *imbricatus* illustrate such forms, and even Sluiter's *Ocnus javanicus* may be ranked with them, though Sluiter points out that no true scales are to be found. These four forms appear to have the pedicels in all or most of the ambulacra arranged in distinct simple rows. For my own part, I cannot suppress my doubts as to the validity of these generic characters, which may be artificial. Even true *Cucumariæ* are armed with scales, though such species are very rare.

A. Interambulacra naked.

Ocnus pygmæus, Semper, 1868.

Dorsal and lateral ventral ambulacra with a simple row, each composed of six to eight pedicels. Odd ambulacrum with a double row of about sixteen pedicels. Deposits—large scales; and perforated plane or slightly concave disks, often with four holes slightly larger than the rest. Calcareous ring of ten pieces, the radial with a long bifurcate prolongation posteriorly.

Habitat.—Bohol (Semper).

Ocnus imbricatus, Semper, 1868.

Each of the five ambulacra with a simple row of hard pedicels; each row containing twenty-four to twenty-six pedicels. Deposits—large, overlapping scales; and small rosette-shaped bodies. The ten pieces of the calcareous ring truncated, not prolonged, posteriorly.

Habitat.—Bohol (Semper).

Ocnus javanicus, Sluiter, 1880.

Each ambulacrum with a simple row of twenty to twenty-three hard, brittle pedicels. Deposits—reticulate spheres resembling those in *Colochirus;* and an almost continuous calcareous network making the perisome very hard. Calcareous ring of ten simple pieces, the radial with a bifurcate posterior prolongation.

Habitat.—Java (Sluiter and Ludwig).

Neither from the description nor from the figures, drawn by Sluiter, is it possible to get a true idea of the shape of the deposits. In the description Sluiter speaks of "spheres" like those in *Colochirus*, and in the explanation of plates he enumerates three kinds, viz., "buttons," "tables," and "calcareous network."

B. Interambulacra with pedicels at the middle of the body.

Ocnus molpadioides, Semper, 1868.

Pedicels of the ventral surface longer and more numerous than those of the dorsal. Deposits—rounded smaller, and angular larger scales. The radial pieces of the calcareous ring with a long bifurcate posterior prolongation.

Habitat.—China (Semper).

Genus 3. Echinocucumis, Sars, 1859 and 1861.

Tentacles ten, unequal, two lateral much larger than the four dorsal, which in their turn are slightly larger than the four ventral. Ambulacral appendages—pedicels, arranged in rows on the ambulacra. Interambulacra naked. Integument rough. Deposits—crowded, perforated plates with a long spire or spine (= tables).

Echinocucumis typica, Sars, 1859, 1861. *Eupyrgus hispidus*, M'Andrew and Barrett, 1857.

Pedicels in alternating double rows along the ambulacra; those on the two dorsal ambulacra are much rarer and totally disappear at the middle of the body. The tables formed by a large, thin, circular or oval disk, with the numerous small round holes slightly smaller near the more or less uneven margin, and arranged in rows; the long spire is conical, spinous, and excentric in position

and perforated with longitudinal rows of holes. Calcareous ring made up of ten simple pieces without posterior prolongations; the five ventral pieces larger.

Habitat.—Norway (Sars, Storm, Möbius and Bütschli), several localities in the North Atlantic Ocean near Norway (Danielssen and Koren), Arctic Sea north from Norway (Hoffmann), north of Scotland (Théel), Bay of Biscay (Norman), Florida Reef (Pourtalès).

(Mus. Holm.) Several specimens from Norway.

"Porcupine" Expedition.—One specimen from Station 15, June 16, 1869; lat. 54° 1′ N., long. 12° 14′ W.; depth, 422 fathoms.

Echinocucumis adversaria, Semper, 1868.

Pedicels long, in double rows on the posterior narrow caudal portion; on the rest of the body they are placed three to four in breadth in the ventral ambulacra but are more rare in the dorsal. Disks of the tables deeply incised in the margin, thus acquiring a stellate or angular appearance; consequently the holes are fewer and placed in a manner different from that in the preceding species; the spire consists of a simple, long, imperforate spine. Tentacles unknown. Calcareous ring absent.

Habitat.—Bohol, Pandanon (Semper).

(?) *Echinocucumis alba* (*Chirodota* (?)), Hutton, 1872 and 1879.

Habitat.—New Zealand (Hutton).

The species is quite unknown, and certainly does not belong to this genus.

Genus 4. Colochirus, Troschel, 1846.

Tentacles ten, two ventral smaller. Anterior extremity of the body usually with five valves. Ambulacral appendages of two kinds—pedicels and papillæ, the latter often situated on the top of warts or protuberances. Pedicels, confined to the ventral surface, are, with a few exceptions, placed on the three ambulacra, thus forming distinct longitudinal series. The most anterior and posterior portions of the ventral surface are devoid of pedicels, which here are exchanged for papillæ. Exceptionally, papillæ may also be found scattered over the ventral interambulacra. Papillæ strictly belonging to the dorsal surface, where they form rows along the ambulacra alone, or are irregularly distributed all over that surface. Calcareous ring of ten simple pieces, devoid of posterior prolongations, three ventral pieces often narrower. Deposits—larger or smaller reticulate scales, together with one or several kinds of small bodies.

A. Ambulacral appendages of the ventral surface distributed over the ambulacra, as well as interambulacra, an arrangment of them in rows not being indicated or very indistinctly. Dorsal papillæ scattered, not placed on warts or protuberances.

Colochirus spinosus (*Holothuria*), Quoy and Gaimard, 1833; Selenka, 1868; von Marenzeller, 1881. *Cladolabes spinosus*, Brandt, 1835. *Stolus firmus*, Selenka, 1867. *Ocnus spinosus*, Semper, 1868. *Thyone firma*, Semper, 1868. *Thyone spinosa*, Semper, 1868.

Body oval or elongated, not angulated, more tapering posteriorly, with oval and anal portions turned upwards. Dorsal papillæ minute, and, like the ventral pedicels, scattered irregularly. A row of hard conical points along each side of the ventral surface. Deposits—large, knobbed buttons, with four holes; slightly smaller flat, spinous cups made up of a ring and a central × -shaped rod; and reticulate thick scales. Perisome hard.

Habitat.—China (Selenka), Port Jackson (Quoy and Gaimard).

(Mus. Holm.) Three specimens from Australia.

Colochirus inornatus, von Marenzeller, 1881.

Body elongated or fusiform, not angulated. Dorsal papillæ minute, scattered. Ventral ambulacral appendages—small pedicels and papillæ of nearly equal size, the former disposed in irregular series along the three ambulacra, and, besides, scattered on the interambulacra, the latter mingled with the former in the interambulacra; the longitudinal series of pedicels being thus indistinct. Deposits—reticulate, very flat, spinous cups; knobbed buttons with four to six holes, or more; perforated plates; and not very large scales.

Habitat.—Japan or China (von Marenzeller).

B. Ventral pedicels in three distinct longitudinal series; ventral interambulacra naked. Dorsal papillæ situated on larger or smaller warts or conical processes.

I. Dorsal papillæ in rows on the ambulacra; dorsal interambulacra naked.

1. *Pedicels, four to eight rows in each ventral ambulacrum.*

Colochirus quadrangularis (*Holothuria*), Lesson, 1830; Selenka, 1868 (*partim*); Semper, 1868. *Colochirus coeruleus*, Semper, 1868.

Body quadrangular. Dorsal ambulacral appendages very large, placed along the four angles of the body; four to six rows of pedicels in each ventral ambulacrum. Deposits—scales; reticulate spheres and cups; and small plates with four larger and some smaller holes, and with spines on one end.

Habitat.—Bohol (Semper), (?) Africa and Australia (Semper), Sumatra and Macassar (Ludwig), Offack in Waigou Island (Lesson).

(Mus. Holm.) One individual, 150 mm. long, from Hong Kong. Colour, yellowish or greyish-white, with some traces of a violet or bluish tone here and there, indicating the true colour of the living animal. Body quadrangular, with the mouth bent upwards and closed by five ridges or protuberances provided with processes. Anus dorsal, surrounded by five distinct teeth. A simple or alternating row of rather large conical processes is placed on each of the four angles, each row or angle having from twelve to sixteen such processes. The processes reach 15 mm. in length. Pedicels five to seven in breadth in each ventral ambulacrum. Another specimen, 75 mm. long, obtained in the Gulf of Siam, has a brown colour and only three to four pedicels in breadth in each series. A third individual from Australia is peculiar in that the left dorsal interambulacrum carries three protuberances, and the odd interambulacrum one.

Colochirus jagorii, Semper, 1868.

Body quadrangular. Dorsal processes not very large, arranged in simple irregular rows along the ambulacra. Ventral pedicels, five to six rows in each series. Anus with five teeth. Deposits like those in the preceding species.

Habitat.—Singapore (Semper).

The species is unsatisfactorily known. Semper omits to tell whether processes with papillæ are present also on the sides of the body on the boundary between the dorsal and ventral surfaces. If it be so, the species may probably be identical with the preceding one.

Colochirus tristis, Ludwig, 1875.

Dorsal appendages—large tubercles with papillæ disposed in longitudinal rows. Pedicels of the odd ambulacrum about eight in breadth; those of the lateral ambulacra about six in breadth. Anus with five small teeth. Deposits—delicate spheres and cups; larger reticulate spheres; and scales which in the dorsal integument reach a diameter of 2 mm.

Habitat.—Zanzibar (Ludwig).

Body-form unknown. Even the arrangement of the tubercles, whether they belong to the two dorsal ambulacra alone, is not fully clear.

2. *Pedicels, one or two, seldom three, rows in each ventral ambulacrum.*

Colochirus minutus, Ludwig, 1875.

Body quadrangular. The two dorsal ambulacra with a few minute papillæ. Pedicels not very numerous, arranged in a double row along each of the three

ventral ambulacra. Anus with teeth. Deposits—reticulate spheres or cups; large scales.

Habitat.—Bowen (Ludwig).

(Mus. Holm.) Two specimens, 18 mm. long, from Bowen in Australia. Besides the large scales and the cups, I find in the perisome other bodies, which seem to resemble the "buttons" in *Colochirus australis*, and are probably developmental stages of scales. For the rest, the specimens fully agree with those described by Ludwig. It seems not incredible that *Colochirus minutus* is a younger form of *Colochirus australis*.

Colochirus australis, Ludwig, 1875.

Body quadrangular. The two dorsal ambulacra with one or two rows of papillæ. Two, seldom three, rows of pedicels in each of the ventral ambulacra. Anus with small teeth. Deposits—reticulate half spheres or cups; numerous knobbed buttons; large scales.

Habitat.—Bowen and Sydney (Ludwig), Port Molle and Port Jackson (Bell).

(Mus. Holm.) Two individuals from Port Jackson and one from Bowen. The largest, 70 mm. long. The papillæ, forming an alternating double row on the two dorsal ambulacra, pass out from a low hard knobbed wart. As usual in this genus, papillæ may also be found anteriorly and posteriorly on the three ventral ambulacra. Interambulacra naked. Those pedicels which form the outer row in the two lateral series seem either to issue from very low knobby warts or to be surrounded at the base by calcareous knobs. The larger and smaller scales do not imbricate, except at the posterior end of the body. The knobbed buttons, seldom of a more symmetrical form, often become developed into irregular spheres.

II. Dorsal papillæ scattered on the ambulacra as well as interambulacra.

Colochirus australis, var. *armatus*, von Marenzeller, 1881; Ludwig, 1883. *Colochirus armatus*, v. Marenzeller, 1881.

Habitat.—Japan (v. Marenzeller and Ludwig).

This variety differs mainly from the species itself in that even the dorsal interambulacra carry small warts with papillæ, and in that three to four rows of warts are present along the dorsal ambulacra. The scales are also smaller and the skin thinner.

Colochirus cylindricus, Semper, 1868.

Body cylindrical, slightly flattened below. Dorsal surface with crowded, larger and smaller tubercles with papillæ. Two to three rows of pedicels in each

ventral ambulacrum. Deposits—delicate, reticulate spheres; more strongly formed spheres; and scales.

Habitat.—Bohol (Semper).

Colochirus cucumis, Semper, 1868.

Body quadrangular. Each of the two dorsal ambulacra with a row of rather large papillæ; also a few, smaller scattered papillæ on the three upper interambulacra. Pedicels two in breadth in each ventral ambulacrum. Deposits—reticulate cups and spheres; scales.

Habitat.—Bohol (Semper).

(Mus. Holm.) One specimen dredged at Japan, 38 mm. long and 14 mm. broad, of a distinctly quadrangular appearance. Each of the three ventral ambulacra composed of two rows of pedicels; owing to contraction, three pedicels seem to be placed side by side in the middle of the lateral ventral ambulacra. The dorsal papillæ run out from lower or higher conical protuberances, the largest about 4 mm. long, forming a zigzag row along the two dorsal ambulacra. The sides of the body carry only a few smaller papillæ, and the space above the pedicels seems to be totally in want of them, or bears some very minute ones. Deposits—larger and smaller scales; reticulate spheres and other developmental stages of scales; small reticulate spheres and cups.

Colochirus peruanus, Semper, 1868.

Body *Ascidia*-shaped. Papillæ irregularly scattered over the back. Pedicels forming two rows along each ventral ambulacrum. Deposits—scales, and reticulate cups.

Habitat.—Peru (Semper).

Colochirus tuberculosus (*Holothuria*), Quoy and Gaimard, 1833; Semper, 1868. *Holothuria pentagona*, Quoy and Gaimard, 1833. *Stichopus tuberculatus*, Brandt, 1835. *Stichopus pentagonus*, Brandt, 1835. (?) *Colochirus quadrangularis*, Troschel, 1846. *Cercodemas anceps*, Selenka, 1867. *Cucumaria pentagona*, Semper, 1868. *Colochirus anceps*, Semper, 1868.

Body more or less elongatedly oval, not angular, or indistinctly so. Dorsal papillæ irregularly scattered, never attaining any considerable size. Pedicels forming four to six rows on each ambulacrum. Deposits—reticulate spheres or cups, and large irregular scales.

Habitat.—Tonga (Quoy and Gaimard), Port Jackson (Quoy and Gaimard), Port Molle, Port Denison, Torres Strait (Bell), Macassar (Ludwig), Malacca (Troschel), Singapore, Bohol (Semper), Hong Kong (Selenka, Semper), Amoy (Ludwig), Japan (Semper).

(Mus. Holm.) Two specimens, one from Australia, and the other from Guam, the

former 70 mm. long, the latter 163 mm. long. Body cylindrical or elongate, oval, nearly equally rounded at each extremity, neither quadrangular nor pentagonal, possibly slightly flattened on the sides and on the back. The closed mouth and the anus slightly bent upwards, the former surrounded by five not very large ridges, the latter with five distinct teeth. Five to six pedicels are placed side by side in each of the three ventral ambulacra, excepting towards the extremities of the body, where they decrease in number, and papillæ become substituted for them. The dorsal papillæ, more thinly scattered all over the back, are situated on the tops of low protuberances, those in the neighbourhood of the two dorsal ambulacra being slightly larger and more closely placed. Along the sides of the body, exteriorly to and above the lateral ventral ambulacra, there is a rather broad almost naked space. The thick perisome is filled with crowded deposits of several different kinds—large, irregularly rounded, thick, not overlapping scales; numerous crowded, delicately constructed reticulate spheres; scattered larger and more solid spheres, which seem to be transformed into scales; and numerous more or less irregularly formed, reticulate cups with spines round the uneven rim, these cups being present in the exterior layer of the perisome.

The following species of *Colochirus* are unsatisfactorily known, and require to be re-examined:—

Colochirus viridis, Semper, 1868.

Body cylindrical, flattened below. Dorsal ambulacra with two rows of conical papillæ. The odd ambulacrum with two rows of pedicels; the lateral ventral ambulacra with an inner simple row of pedicels and an exterior row made up of papillæ.

Habitat.—Samboanga (Semper).

Deposits unknown. According to the figure, drawn by Semper, the dorsal papillæ seem to be slightly irregular in position.

Colochirus colloradiatus, Haacke, 1880.

Pedicels sparingly distributed, forming one or two rows on each of the three ventral ambulacra. Papillæ very scattered, placed in a simple row along each of the two dorsal ambulacra. Deposits—scales in the dorsal perisome; two kinds of regularly formed bodies; and also irregularly formed bodies in different portions of the body.

Habitat.—Mauritius (Haacke).

Colochirus propinquus, Haacke, 1880.

Nearly allied to the preceding form, but distinct from it by the absence of regularly formed buttons.

Habitat.—Mauritius (Haacke).

Colochirus doliolum (*Actinia*), Pallas, 1766; von Marenzeller, 1874. *Holothuria doliolum*, Lamarck, 1816 (*partim*). *Pentactes doliolum*, Jæger, 1833 (*partim*). *Cladodactyla doliolum*, Brandt, 1835.

Habitat.—Cape of Good Hope (Pallas).

Genus 5. Actinocucumis, Ludwig, 1875.

Tentacles eighteen to twenty, unequal and irregularly disposed, two ventral being always smallest. Ambulacral appendages—pedicels and papillæ; the former arranged in several (four to six) rows along each ambulacrum; the latter, very small, scattered on the dorsal interambulacra and also among the pedicels on the dorsal ambulacra.

Actinocucumis typica, Ludwig, 1875.

Deposits—very numerous, small, perforated acorn-shaped bodies. Calcareous ring composed of ten simple pieces without posterior prolongations.

Habitat.—Bowen (Ludwig), Amoy (Ludwig).

Actinocucumis difficilis, Bell, 1884.

Habitat.—Albany Island, Torres Strait, Kurrachee (Bell).

Bell says:—"I have had the greatest difficulty in assuring myself of the specific distinctness of this form from the *Actinocucumis typica* of Ludwig." So far as I can judge, there exist no other differences between these two forms than in the shape of the deposits, these being in the species of Bell more simple, 8-like, with two holes and some knobs. Considering that even such deposits are not rare in the species of Ludwig, I am much inclined to refer them to one and the same species. Bell does not describe the calcareous ring.

Genus 6. Pseudocucumis, Ludwig, 1875.

Tentacles twenty, ten larger and ten smaller, alternating two and two; some of the smaller tentacles forming an inner crown. Ambulacral appendages in the shape of pedicels, arranged in rows along the ambulacra. Interambulacra naked. Calcareous ring composed of ten simple pieces without posterior prolongations.

Pseudocucumis acicula (*Cucumaria*), Semper, 1868; Ludwig, 1875; Schmeltz, 1879.

Ventral ambulacra with three or four rows of pedicels, dorsal with only one or two.

Deposits—peculiarly shaped needles, with holes at the obtusely rounded base.

Habitat.—Fiji Islands (Semper, Ludwig), Mauritius (Haacke, Ludwig), Ceram (Ludwig).

(Mus. Holm.) Eleven specimens of this very characteristic and easily recognised form; two dredged at Fiji Islands and nine at Tonga.

Genus 7. Amphicyclus, Bell, 1884.

Tentacles twenty-four, in two circles, those in the inner circle smaller, arranged in pairs, ten in number and radial in position; those of the outer fourteen, subequal. Calcareous ring and other deposits, excepting terminal plates in the pedicels and rods in the tentacles, absent. Ambulacral appendages in the shape of pedicels confined to the ambulacra and arranged in regular rows; in the dorsal ambulacra they are set in pairs, but are a little more irregular and crowded in the ventral. Interambulacra naked.

Amphicyclus japonicus, Bell, 1884.

Habitat.—Lat. 41° 12′ N., long. 140° 45′ E.; 43 fathoms; sand and mud (Bell).

A further examination will possibly shew such a close relation between this species and *Pseudocucumis acicula*, that they may be referred to the same genus.

Subfamily 2. Gastropoda.

Ambulacral appendages in the shape of pedicels alone, arranged in distinct rows on the flat, discoidal, sole-like, ventral surface. The convex dorsal surface naked, mostly covered with large scales. Tentacles ten, exceptionally fifteen, nearly equal. Calcareous ring of ten simple pieces, not prolonged posteriorly.

Genus 8. Psolus, Oken, 1815.

I. Tentacles ten.

A. Pedicels in three complete longitudinal series.

1. *Dorsal perisome devoid of large scales, only with minute plates or grains.*

Psolus regalis, Verrill, 1866; Bell, 1882. *Psolus granulatus*, Ayres, 1854.

Body like that of *Psolus phantapus*, though longer and narrower, and "its elongate-conical tail is much more nearly the result of a gradual tapering of the body" (according to Bell). The sole quadrangular. The lateral series of pedicels composed of about four rows; the odd series much narrower. Dorsal perisome

having a nearly uniform layer of innumerable minute, perforated plates, over which are scattered numerous round granules. Deposits of the sole like those in the dorsal surface, though less in quantity.

Habitat.—Banks of Newfoundland, George's Bank (Ayres).

According to Ayres the plates of the dorsal surface bear a strong resemblance to those in *Stereoderma unisemita*, being oval, smooth and usually pierced with four holes.

Psolus ornatus (*Lissothuria*), Verrill, 1867–1871.

Body elongated, depressed, with the flat lower surface broad. Anal region not very prominent. Pedicels numerous, forming six to eight rows in each longitudinal series. The soft dorsal perisome filled with minute grains, and fewer, somewhat larger, perforated ones. Round the naked part of the body below the tentacles, a ring of calcareous plates with pointed ends.

Habitat.—Panama (Verrill).

The species is unsatisfactorily known, and needs re-examination.

2. *Dorsal integument supported by large scales.*

Psolus phantapus (*Holothuria*), Strussenfeldt, 1765; Jæger, 1833. *Ascidia rustica*, Pennant, 1777. *Cuvieria phantapus*, Fleming, 1828; Düben and Koren, 1844. *Psolus lævigatus*, Ayres, 1854.

Body subcylindrical, *Ascidia*-shaped, with each extremity turned up; anal region elongatedly conical, caudiform. Sole rectangular. The lateral series of pedicels composed of two to three rows; the odd ambulacrum, at least in its middle, with only a simple row. The thick leathery dorsal integument with large granulated scales imbricating upon one another. The sole strengthened by reticulate cups and spheres.

Habitat.—West coast of Scandinavia from the Sound to Finmark (O. F. Müller, Danielssen and Koren, Lütken, Möbius and Bütschli, Sars, Düben and Koren, Möbius, &c.); Spitzbergen (Ljungman), Arctic Sea north from Norway (Hoffmann), Greenland (Lütken, Fabricius, Duncan and Sladen, &c.), White Sea (Jarzynsky), Iceland (Lütken), British Islands (Hodge, Dalyell, Lütken, M'Intosh, Forbes, Leslie and Herdman, Norman); east coast of North America, Banks of Newfoundland and Cape Cod (Ayres), Grand Manan (Stimpson), Chelsea Beach, Mass., Mount Desert, Eastport, Maine, Massachusetts (Verrill).

(Mus. Holm.) A great number of specimens from different localities of Scandinavia.

Psolus complanatus, Semper, 1868.

Body very much depressed. The lateral series of pedicels composed of four to six rows; the odd series, on the contrary, made up of two to three rows. The number of

scales across the whole breadth of the dorsal surface is fourteen to sixteen. Between mouth and anus ten to twelve larger and several smaller scales may be found. The scales slightly granulated. Deposits in the sole—rather symmetrical oval buttons with about four holes and rather large knobs round the uneven margin, and with a larger central knob; smaller, asymmetrical, knobbed, irregularly perforated bodies with the margin uneven and dentate.

Habitat.—Samboangan (Semper).

Psolus boholensis, var. *pandanensis*, Semper, 1868.

Body probably Ascidia-shaped. Lateral series of pedicels composed of two to three rows; the odd series composed of one or two rows. Number of scales across the dorsal surface, ten to twelve; between mouth and anus ten to twelve larger and several smaller scales are present. Deposits of the sole—asymmetrical plates with uneven margin, pierced with a few holes and provided with some small knobs; smaller asymmetrical plates with a few holes and dentate or spinous margin.

Habitat.—Bohol and Pandanon (Semper).

B. Pedicels on the two lateral ambulacra alone; odd ambulacrum naked or with an incomplete series of pedicels.

1. *Dorsal integument covered with scales.*

Psolus boholensis, Semper, 1868..

Body *Ascidia*-shaped, with the anal portion conical. Lateral series of pedicels composed of two to three rows; odd ambulacrum with an incomplete series of pedicels, its middle being naked. Dorsal surface with fifteen to sixteen scales across its breadth, and twelve to thirteen between mouth and anus. Deposits of the sole almost like those in the preceding variety.

Habitat.—Bohol (Semper).

Psolus fabricii (*Cuvieria*), Düben and Koren, 1844; Lütken, 1857; Kingsley, 1881; Ludwig, 1881; Bell, 1882. *Holothuria squamata*, Fabricius, 1780. (?) *Ascidia squamata*, Pallas, 1788. *Cuvieria sitchaensis*, Brandt, 1835. *Cuvieria squamata*, A. and E. C. Agassiz, 1865 (according to Verrill). *Lophothuria fabricii*, Verrill, 1866. *Psolus sitchaensis*, Semper, 1868.

Body depressed, *Chiton*-shaped, its periphery presenting an oval form. Lateral series of pedicels composed of two to five rows; anteriorly and posteriorly the odd ambulacrum carries some pedicels. Dorsal surface covered with large imbricating scales, with the free margin rounded and tightly covered with large granules,

which, however, in old specimens are not unfrequently abraded in places. Near the mouth and anus the scales are smaller and grouped around the openings, where a number of them are transformed into wart-like tubercles. The scales bordering the margin of the dorsal surface much smaller. The sole with reticulate cups or spheres.

Habitat.—Arctic Ocean, north from Norway (Danielssen and Koren, Hoffmann), north from Nova Zembla (v. Marenzeller), Greenland (Düben and Koren, Lütken, Norman, Duncan and Sladen, Ludwig), Newfoundland (Lütken), Grand Manan (Stimpson, Ludwig, Verrill), New England (Ayres), Massachusetts (Lütken, Bell, Gould, Verrill), Massachusetts Bay to Greenland (Verrill), Sitka (Brandt), Japanese Sea (Bell), (?) Kurile Islands (Pallas), (?) St. Paul in Bhering Sea (Middendorff). (Mus. Holm.) Numerous specimens from different localities of the Arctic Sea.

Psolus squamatus (*Cuvieria*), Düben and Koren, 1844; Koren, 1844; Sars, 1861; Bell, 1882. (?) *Holothuria squamata*, O. F. Müller, 1788. *Lophothuria squamata*, Verrill, 1873.

Body depressed, like that of the preceding species. Lateral series of pedicels composed of two to four rows. Odd ambulacrum always naked, though it possesses some pedicels in its anterior and posterior portions. Scales large, imbricating upon one another, with rather uneven margin, and covered with fine granules only. The sole, devoid of the cup-shaped bodies, is supported by more or less scattered, irregular, reticulate slightly spinous or knobbed plates.

Habitat.—West coast of Scandinavia from Bergen to Lofoten and Finmark (Sars Düben and Koren, Danielssen and Koren, Möbius and Bütschli, Barrett and M'Andrew), British Islands (Norman, Hodge), Gulf of St. Lawrence (Bell), coast of New England (Verrill).

The characters distinguishing the three last species appear to be very unimportant, and there may be a question whether they are distinct or not. However, *Psolus boholensis* has an *Ascidia*-shaped body, while the other two have it depressed, and the anal portion not prolonged into a conical tail. None of them have the large oral valves, peculiar to several of the following species.

Psolus peronii (subgenus *Lophothuria*), Bell, 1882.

Habitat.—(?)

Judging from the description of Bell, the general appearance of this species must be very like that of *Psolus squamatus*, and it is distinguished mainly by "a very large number of scales, only slightly imbricated near the margin," and by the possession of cup-shaped deposits in the ventral sole.

Psolus ephippifer, Wyville Thomson, 1877 and 1878.

Habitat.—Heard Islands (W. Thomson).

This Antarctic species is easily known from the Arctic forms, *Psolus fabricii* and

Psolus squamatus, by its small size and by having distinct oral and anal valves, and only two rows of pedicels around the sole. Its affinity with the two following species is much more apparent, and is such that it is almost impossible to draw a line of demarcation between them. Compare the above description.

Psolus operculatus (*Cuvieria*), Pourtalès, 1868, 1869. *Lepidopsolus* (*?*) *operculatus*, Verrill, 1867–1871.

Body oval, flattened, covered with finely and sparsely granulated scales, very compactly imbricated, but overlapping very little excepting near the mouth and anus. Oral aperture closed by five large triangular scales, alternating with and covering five narrow, tooth-shaped ones. Anus closed in the same way, but the scales are much less regular and constant. A double row of pedicels surrounds the soft sole, those of the outer row perforating the marginal plates; sometimes two or three pedicels are present anteriorly in the odd ambulacrum.

Habitat.—Sand Key and Florida Reefs (Pourtalès).

The species is doubtless nearly allied to *Psolus squamatus*, and appears to differ from it mainly in having larger, more regular oral valves, and in having only two rows of pedicels around the sole. Pourtalès does not describe the armature of the sole.

Psolus antarcticus (*Cuvieria*), Philippi, 1857; Semper, 1868; Studer, 1877; Bell, 1882. *Lepidopsolus* (*?*) *antarcticus*, Verrill, 1867–1871.

Habitat.—Strait of Magellan (Philippi, Studer), Portland Bay and Cove (Bell). According to Philippi, this species is nearly related to or identical with *Psolus squamatus*. Bell says that the body is much more flattened than in the last-mentioned form, and that the oral and anal valves are very much larger and more regularly arranged. Indeed, the oral valves consist of five large triangular scales, and the anal ones are also five but smaller. The scales covering the dorsal surface are large, so that only about five (Philippi) or ten to eleven (Studer) are placed between mouth and anus; they are also much less granulated or nearly smooth. Round the margin of the dorsal surface the scales are much smaller. Only a double row of pedicels is present round the sole. The deposits in the sole have not been described.

2. *Dorsal integument without scales* (*?*).

Psolus poriferus (*Cuvieria*), Studer, 1877 and 1879.

Dorsal surface furrowed, so as to present irregular poriferous spaces. Round the margin, however, poriferous scales seem to be present.

Habitat.—Royal Sound, Kerguelen (Studer).

The description given by Studer is very summary and unsatisfactory. The species is possibly identical with Bell's *Psolus ambulator*.

II. Tentacles fifteen.

Psolus cataphractus (*Stolinus*), Selenka, 1868; Bell, 1882. *Holothuria cuvieria*, Cuvier, 1817. (?) *Cuvieria cuvieria*, Jæger, 1833. (?) *Psolus cuvierius*, Semper, 1868.

Dorsal integument very smooth and stone-hard. Mouth and anus stellate, the latter not situated on a conical tail. Pedicels of the sole in three longitudinal series; round the sharp margin, which surrounds the sole, is a row of small pedicels without supporting terminal plates. Deposits—reticulate cups, which in the dorsal integument are more closely crowded and partly grown together so as to make it uncommonly hard.

Habitat.—Australia (Selenka).

Psolus ambulator (subgenus *Hypopsolus*), Bell, 1882.

Body like that in the preceding, without any tail. Each lateral ventral series of pedicels composed of five or six rows, and the odd series of about ten rows. The very large dorsal scales, which form about six not very regular rows of about four or five scales in each, are covered by a rather thick integument, and do not imbricate with one another. Five very large triangular scales surround the mouth; the five anal scales are particularly small. Many of the large scales have one, two, or rarely three small pores in their integument, which communicate with a small pit in the plate itself. Round the margin the scales are small and imbricating. Tentacles unknown.

Habitat.—Australia (Bell).

(Mus. Holm.) One specimen from Australia, which is certainly to be referred to this species of Bell; moreover, as will be seen from the following description, the general appearance and organisation of the species examined by me are much the same as those in Selenka's *Psolus cataphractus*; a resemblance in several important respects so striking that there is but little doubt they are identical. Thus, further investigations will certainly prove that *Psolus cataphractus* and *Psolus ambulator* are synonymous.

The specimen in question has the following measurements:—length of the sole 37 mm., breadth of the sole 12 mm.; height of the anterior part of the body 17 mm., height of the posterior part of the body 8 mm. Thus the animal does not attain more than half the size of that examined by Bell. Tentacles fifteen, somewhat unequal. Each lateral ambulacrum with three or four rows of pedicels; the unpaired ambulacrum with a broader series of pedicels. The five triangular oral valves are very considerable, while the anal valves are particularly small, giving to the anus an irregularly stellate aspect. The scales of the back are of various shapes, very large and thick, so that there are only four or five between the anus and the oral valves, and only about five across the back from brim to brim. The brim, or the lower part of the sides, forming the margin of the animal, is supported by a number of small scales. The whole back is covered by

a rather thick integument, containing numerous small, irregular, reticulate cups and spheres, the latter barrel-shaped, sparsely provided with bars, so that the meshes become large; the former made up of a much closer network with smaller, more irregular meshes, and with the spinous opening closed by spinous bars. The sole seems mostly to have cups or rather flattened hollow bodies made up of an irregular network, and with spines in the outwardly directed surface. Only a few of the large dorsal scales have distinct pores, which possibly are in communication with the ambulacral system (?), and, if it be so, we have an example in a *Psolus* with dorsal papillæ. The retractor muscles are united to the longitudinal muscular bands by a muscular membrane just as is described by Selenka in *Psolus cataphractus*.

The following two species are very incompletely described and impossible to identify:—

Psolus appendiculatus (*Holothuria*), Blainville, 1821; Jæger, 1833.

Habitat.—Mauritius (Blainville, Hoffman).

Psolus forbesii, Couch, Peach, 1845.

Habitat.—British Islands (Peach).

The great conformity in internal and external organisation makes it impossible, for the present, to point out any true characters distinguishing the greater part of the species of this genus. It represents a very interesting group of Holothurians on account of the numerous transitional forms which unite the extremes. One may question whether all the forms characterised by the possession of only two lateral series of pedicels are anything else than varieties of one species.

Subfamily 3. Sporadipoda.

Ambulacral appendages, almost without exception, in the shape of pedicels, scattered all over the body; seldom an arrangement of them in rows distinguishable. Tentacles ten to twenty. Calcareous ring of ten pieces, which are simple or compounded of smaller parts; the five radial pieces often prolonged and bifurcate posteriorly.

Genus 9. Thyone, Oken, 1815; Semper, 1868.

Tentacles ten, two ventral smaller. Pedicels more or less crowded all over the body; very seldom an arrangement of them in rows along the ambulacra discernible.

A. Anus with five calcareous teeth.

I. Calcareous ring composed of ten simple pieces, devoid of posterior prolongations.

Thyone suspecta, Ludwig, 1875.

Deposits very rare, but present in two forms—oval plates with uneven margin and about four holes; and cups likewise pierced with four holes and with the rim uneven. Pedicels with numerous supporting rods.

Habitat.—Barbados (Ludwig).

Ludwig supposes this species to be identical with *Thyone braziliensis* of Verrill, but if the statements of Verrill be right, it seems more credible that Ludwig's species is distinct, *Thyone braziliensis* being probably synonymous with *Thyone briareus*. Ludwig mentions twenty tentacles, which evidently is a misprint.

Thyone surinamensis, Semper, 1868.

Deposits—closely crowded, knobbed buttons; and scattered tables without disks. Anal teeth minute.

Habitat.—Surinam (Semper).

Thyone spectabilis, Ludwig, 1882.

Deposits—slightly curved rods with the ends perforated, branched, or spinose.

Habitat.—Strait of Magellan (Ludwig).

(Mus. Holm.) Numerous large specimens dredged during the "Eugenie" Expedition at Cape Virgins. This large *Thyone* is characteristic, agreeing in all respects with the description of Ludwig. Colour, yellowish-brown. Tentacles large, of equal size. Pedicels evidently more crowded on the ventral than dorsal surface, posteriorly more limited to the ambulacra. Calcareous ring rather solid, without any posterior prolongations. Polian vesicle and madreporic canal single. The smooth or slightly spinose rods are not very close together.

II. Calcareous ring composed of ten simple pieces, the radial with a bifurcate prolongation posteriorly.

1. *No deposits in the body-wall itself.*

Thyone briareus (*Holothuria*), Lesueur, 1824; Selenka, 1867. *Anaperus briareus*, Pourtalès, 1851. *Sclerodactyla briareus*, Ayres, 1854 and 1873. (?) *Thyone* (*Sclerodactyla*) *braziliensis*, Verrill, 1867–1871.

Deposits of the pedicels—terminal plates and tables with rod-like disk. Calcareous ring of ten simple pieces, firmly grown together; the radial with bifurcate prolongations posteriorly.

Habitat.—Several localities between Texas and Cape Cod, viz., East Florida (Pourtalès), West Florida (Verrill), Charleston (Selenka, Ludwig), North Carolina (Verrill), Sagharbor (Ayres), New Jersey (Lesueur, Pourtalès, Verrill), Connecticut, Long Island, Thimble Island, Vineyard Sound (Verrill), Fort Macon (Coues and Yarrow), (?) Brazil (Rathbun, Verrill).

(Mus. Holm.) Several specimens dredged at Wood's Hole, Massachusetts, and New York. The largest 100 mm. or more in length. Colour in alcohol almost black; pedicels brownish and their sucking-disks almost white. Anal teeth distinct. Pedicels very numerous and crowded. Deposits present only in the pedicels, consisting of terminal plates and a few tables, which have an elongated, fusiform, curved disk, with about four central holes and one or more at each slightly enlarged end; the spire seems to be made up of four rods. In one of the specimens examined by me, two Polian vesicles and a single madreporic canal were present. Calcareous ring rather large, with the sutures between the radial and interradial pieces visible, thus the ring does not form a continuous whole.

It appears somewhat doubtful whether *Thyone braziliensis* of Verrill is to be referred to this species, its pedicels being less numerous, its calcareous ring smaller, and, according to Verrill, not so distinctly provided with posterior bifurcate prolongations.

Thyone venusta, Selenka, 1868.

Pedicels with terminal plates alone. Radial pieces of the calcareous ring with long, slender, bifurcate prolongations posteriorly; all the ten pieces simple.

Habitat.—Red Sea (Selenka).

2. *Deposits in the shape of tables.*

Thyone fusus (*Holothuria*), O. F. Müller, 1788 and 1789; Koren, 1844; Düben and Koren, 1844. *Holothuria penicillus*, O. F. Müller, 1788 and 1789. *Holothuria papillosa*, O. F. Müller, 1789. *Mülleria papillosa*, Johnston, 1834. *Thyone papillosa*, Forbes, 1841. *Anaperus fusus*, Troschel, 1846. (?) *Holothuria scotica*, Dalyell, 1851. *Thyonidium pellucidum*, Barrois, 1882.

Tables not very close together, composed of an irregular oval or angular disk, mostly with only four holes, but sometimes also with smaller peripheral ones; spire of the tables made up of two rods anastomosing at the top and terminating in small spines.

Habitat.—Scandinavia from the Sound northwards to Lofoten (Sars, Düben and Koren, Koren, Danielssen and Koren, Danielssen, Möbius), British Islands (Thompson, Forbes, Johnston, O. F. Müller, Norman, M'Intosh, Hodge, Herdman, Leslie and

Herdman, &c.), west coast of France (Barrois), Mediterranean Sea (Ludwig, Græffe, von Marenzeller, Sars, &c.).

(Mus. Holm.) Numerous specimens dredged at the west coast of Sweden. Body fusiform, inconsiderably curved. Pedicels tightly placed all over the body. Calcareous ring large; in an individual, 60 mm. long, its length was 20 mm. and breadth 9 mm.; the slender bifurcated prolongations of the radial pieces were 8 mm. long. In some specimens the ten pieces are obviously simple, in others they appear to be composed of several smaller parts, which, however, are not very distinct. Anal teeth more or less minute.

Thyone villosa, Semper, 1868.

Habitat.—Zebu (Semper).

This species must be nearly related to the former, and, in reality, I cannot find out any definite distinctions. The pedicels may possibly be finer and more closely placed in *Thyone villosa*. Semper does not give any description of the deposits, but only a figure, which, however, cannot be fully satisfactory for communicating an idea of their true shape; judging from this figure, I am much inclined to consider the deposits of this species as nearly like those in the preceding. *Thyone venusta* of Selenka also bears the closest resemblance to *Thyone fusus*, only differing from it in the want of deposits.

Thyone scabra, Verrill, 1873. (?) *Thyone fusus*, Verrill, 1873.

Deposits—tables composed of an oval, or triangular, or subpolygonal disk with twenty to twenty-four holes, and a spire built up of two anastomosing rods.

Habitat.—Coast of New England (Verrill).

Verrill does not mention anything about anal teeth or calcareous ring, he only declares that the species in question resembles *Thyone raphanus* in form. It may possibly be devoid of anal teeth (?).

3. *Deposits in the shape of perforated plates.*

Thyone raphanus, Düben and Koren, 1844; Hodge, 1872; von Marenzeller, 1878.

The plates are rather large, closely crowded and overlapping. Very seldom minute × -shaped deposits may be found. Body curved with a long slender caudal portion.

Habitat.—Scandinavian west coast northwards to Molde and Christiansund (Düben and Koren, Storm, Sars, Danielssen and Koren), British Islands (Norman, Hodge, Kinahan, Théel, Herdman, &c.), Mediterranean Sea (von Marenzeller, Marion, Ludwig).

(Mus. Holm.) A few specimens dredged off the west coast of Sweden.

"Porcupine" Expedition.—Some large specimens from the Minch.

Thyone poucheti, Barrois, 1882.

Habitat.—West coast of France (Barrois).

This species, if it be really distinct, seems to be one of the nearest relatives of *Thyone raphanus*, from which it differs mainly in the calcareous plates being of a more irregular form, and provided with knobs on their upper surface. "Porcupine" Expedition dredged one specimen at Station 6, 1870, from a depth of 358 fathoms, which may probably be referred to this form. The form of the body, the anal teeth, &c., are like those in *Thyone raphanus*, but the skin is rougher. The deposits partly resemble those described by Barrois, being irregular and plate-like with numerous holes and small knobs; a few become scale-like in that the knobs are united so as to form a thicker reticulate network composed of superposed layers. Length 20 to 30 mm.

III. Calcareous ring composed of ten pieces, each made up of a number of small parts; posteriorly it carries five bifurcate prolongations.

Thyone buccalis, Stimpson, 1856; Semper, 1868.

Deposits—closely crowded, oval knobbed buttons with four holes. Calcareous ring very long, composed of numerous small pieces, and sending posteriorly five long slender, bifurcate prolongations.

Habitat.—Port Jackson (Stimpson), Rockhampton and Port Mackay (Semper), (?) Port Denison (Bell).

(Mus. Holm.) Two specimens from Rockhampton. Body fusiform, indistinctly four or five angled. Mouth with five ridges like that in *Colochirus*. Tentacles ten, three or four ventral smaller. Anal teeth minute. Pedicels equally distributed all over the body, the dorsal apparently running out from low warts. Calcareous ring made of a great number of small pieces, carrying anteriorly ten shorter processes and posteriorly five long slender bifurcated prolongations. Six to eight Polian vesicles and numerous small madreporic canals. Body-wall thick and hard from crowded oval buttons, which are knobbed round the margin, and, as a rule, pierced with four holes; an arch rises vertically to the buttons themselves from each surface. Some of the buttons much smaller and more finely constructed. Pedicels supported by large curved rods, enlarged and perforated with several holes at the middle, and even pierced at the slightly dilated ends; some of the rods are three-armed. Terminal plates are also present in the pedicels. Length of the largest specimen 75 mm. Colour in alcohol, darker or lighter brown; tentacles blackish.

The species completely resembles *Thyone sacella*, excepting that the latter is devoid of anal teeth, which are present in *Thyone buccalis*, though they are very rudimentary. Possibly they may be proved to be identical.

Thyone aurantiaca (*Uroxia*), Costa, 1869; von Marenzeller, 1874; Ludwig, 1880.
Haplodactyla mediterranea, Taschenberg, 1879.

Tables present only in the posterior extremity of the body, composed of a disk pierced with about four larger and four smaller holes; their spires made up of two anastomosing rods.

Habitat.—Mediterranean Sea (v. Marenzeller, Greeff, Ludwig).

"Porcupine" Expedition.—Three specimens from Tangiers Bay, which probably belong to this species, though their deposits were destroyed. The calcareous ring completely resembles that figured by Ludwig. The species must be very closely allied to *Thyone fusus*.

B. Anus devoid of calcareous teeth.

I. Calcareous ring of ten simple pieces, without posterior prolongations.

1. *No deposits in the body-wall itself.*

Thyone meridionalis, Bell, 1883.

Pedicels "absent from the greater part of the bivial surface, well enough developed above, and diminishing in number on either side as they approach the bivium." Very sparsely distributed rods in the pedicels. Tentacles nearly equal.

Habitat.—Strait of Magellan (Bell).

The species is doubtless nearly allied to *Thyone spectabilis*.

2. *Deposits present under several forms.*

Thyone rosacea, Semper, 1869.

Deposits—cruciform bodies and minute grains. Pedicels with long, straight, smooth rods, with the slightly dilated ends branched.

Habitat.—Aden (Semper).

Thyone cunninghami, Bell, 1883.

Deposits—delicate rods, often pitchfork-shaped, or swollen and perforated at their ends, sometimes more irregular in form. Anus fringed with papillæ.

Habitat.—Off Dungeness, Patagonia (Bell).

This species may probably be only a *Thyone spectabilis*.

Thyone gemmata (*Colochirus*), Pourtalès, 1851; Ayres, 1854; Semper, 1868. *Thyonidium gemmatum*, Selenka, 1867. *Thyonella gemmata*, Verrill, 1872. (?) *Thyonella* sp., Rathbun, 1879.

Deposits—oval button-like plates with undulated margins, uneven surfaces, and about four holes; and reticulate cups with the often incomplete margin spinous or uneven. Pedicels in five distinct longitudinal series, and scattered over the interjacent areas.

Habitat.—Sullivan's Island (Pourtalès), North Carolina (Verrill), South Carolina (Ayres, Selenka), Fort Macon (Coues and Yarrow), Florida Reef (Pourtalès) (?) Bahia (Rathbun).

According to Ayres, the radial pieces of the calcareous ring are prolonged posteriorly into two slender branches. Judging from the figure given by Selenka, they are only slightly excavated posteriorly.

II. Calcareous ring of ten simple pieces, the radial with a bifurcate prolongation posteriorly.

Thyone ovulum (*Stolus*), Selenka, 1867; Semper, 1868.

Excepting terminal plates in the pedicels, no deposits. Pedicels very numerous.

Habitat.—Acapulco (Selenka).

Thyone mirabilis, Ludwig, 1875.

Deposits—scattered tables, composed of a roundish perforated disk and a spire of two anastomosing rods. Body slightly quadrangular, with a row of small warts along the dorsal ambulacra. Ventral pedicels much more numerous than the dorsal.

Habitat.—Bowen (Ludwig), Port Denison (Bell).

III. Calcareous ring of ten pieces, each composed of a great number of small parts; posteriorly it carries five bifurcate prolongations.

Thyone sacella (*Stolus*), Selenka, 1867; Semper, 1868; von Marenzeller, 1881. *Thyone rigida*, Semper, 1868.

Deposits—Numerous, somewhat irregularly formed bodies, consisting of a plate with four holes and a smaller bow vertically disposed on each side, thus presenting the view of two rings placed vertically to one another; the larger plate or ring has the undulating rim provided with low elevations.

Habitat.—Bohol (Semper), Japan (von Marenzeller), Torres Strait (Bell), Aden (Semper), Zanzibar (Selenka), Mozambique (Semper).

Thyone gibber (*Stolus*), Selenka, 1867; Semper, 1868.

Deposits like those in *Thyone gemmata*—oval button-like plates with about four holes; and reticulate cups. The pieces of the calcareous ring are firmly united.
Habitat.—Panama (Selenka).

Thyone okeni, Bell, 1884.

Excepting terminal plates in the pedicels, no deposits. Pedicels closely packed.
Habitat.—Port Jackson (Bell).

IV. Calcareous ring composed of five radial pieces alone.

Thyone chilensis, Semper, 1868.

Deposits—spinous rods, sometimes pierced with a few holes. Tentacles of nearly equal size.
Habitat.—Chili (Semper).

The following species are more or less incompletely known and need re-examination:—

Thyone pulcherrima (*Pentamera*), Ayres, 1854; Semper, 1868.

Habitat.—South Carolina (Ayres, Stimpson), North Carolina (Verrill), from South Carolina to Vineyard Sound (Verrill), Fort Macon (Coues and Yarrow).
Judging from the description of Ayres, the pedicels are confined to the ambulacra, forming three well-defined double rows. Semper says that they are present, though rarely, even on the interambulacra. Anus armed with five teeth. Calcareous ring composed of ten pieces, the radial with a posterior bifurcate prolongation. Deposits in numerous, inseparable, perforated layers, their true shape not fully clear. It seems doubtful whether the species really belongs to this genus.

Thyone muricata (*Trachythyone*), Studer, 1877.

Habitat.—Kerguelen (Studer).
This species is a true *Thyone*, though its pedicels run out from conical papillæ. Anus with five teeth. Deposits—oval or triangular plates, perforated with several larger and some smaller holes; they are closely crowded.

Thyone peruana (*Holothuria*), Lesson, 1830; Selenka, 1867 and 1868. *Trepang peruviana*, Jæger, 1833. *Anaperus peruanus*, Troschel, 1846. *Anaperus carolinus*, Troschel, 1846. *Thyone carolina*, Selenka, 1867. *Thyone tenella*, Selenka, 1867 and 1868.

Habitat.—Peru (Troschel), Texas (Selenka), South Carolina (Troschel, Pourtalès).

This species seems to be very unsatisfactorily known. I am much inclined to refer Troschel's *Anaperus carolinus* to *Thyone briareus* of Lesueur. Even Selenka's *Thyone tenella* may without difficulty be referred to the same species, considering that its deposits, figured by Selenka, have certainly supported the pedicels and not the body-wall itself, which will easily be seen from the elongated curved disks of the tables. Whether Lesson's and Troschel's *Thyone peruana* are distinct species or not, cannot be stated at present.

Thyone cigaro (*Anaperus*), Troschel, 1846; Selenka, 1867. *Stolus cigaro*, Selenka, 1868.

Habitat.—Labrador (Troschel).

Seven longer and three shorter tentacles. Pedicels large, crowded. Anus without teeth, but with papillæ. Calcareous ring unknown. Deposits in the perisome absent.

Thyone glabra (*Thyonidium*), Ayres, 1854; Semper, 1868.

Habitat.—George's Bank (Ayres).

Tentacles—three longer, three smaller, two still shorter, and two very short. Pedicels not numerous. Calcareous ring of ten simple pieces, the radial not prolonged posteriorly. Deposits of the perisome absent.

When comparing the imperfect descriptions of these two last forms, one is scarcely able to point out a single distinguishing character of importance. The aberrant conformation of the tentacles is doubtless an individual abnormality, and the number of Polian vesicles and madreporic canals is known to vary in the same species. Both forms agree in the absence of deposits in the body-wall itself, and they are obtained from localities not very distant.

Thyone pedata, Semper, 1868.

Habitat.—China Sea (Semper).

No anal teeth. Ventral pedicels longer and much more crowded than the dorsal. Calcareous ring composed of ten pieces, the interradial simple, the radial having the ends of their posterior prolongations made up of separate small parts. Deposits present, but their shapes unknown.

Thyone musculosa (*Thyonidium*), Ayres, 1854; Semper, 1867.

Habitat.—Massachusetts Bay (Ayres).

Thyone longidentis, Hutton, 1872. *Pentadactyla longidens*, Hutton, 1879.

Habitat.—New Zealand (Hutton).

The descriptions of Hutton are very defective, and certainly give a wrong idea of the species in question. In his later "Notes" Hutton says that the species "belongs to the family Aspidochirotæ, and must form the type of a new genus distinguished by having only five tentacles," &c. Judging from his description of the "dental apparatus," which is "very long, nearly half the length of the body, tubular for half its length, the rest cut into five teeth," I suppose the species to be a Dendrochirote, though possibly not a *Thyone*.

Thyone brevidentis, Hutton, 1872.

Habitat.—New Zealand (Hutton).

Thyone aurea (*Holothuria*), Quoy and Gaimard, 1833; Semper, 1868. *Cladolabes aureus*, Brandt, 1835.

Habitat.—Cape of Good Hope (Quoy and Gaimard).

Thyone inermis, Heller, 1868.

Habitat.—Mediterranean Sea (Heller).

Excepting a network in the ends of the pedicels, no deposits.

Thyone andrewsii, Farran, 1852 (according to Kinahan, 1859).

Habitat.—Ireland (Farran and Kinahan).

Thyone flexus, Hodge, 1865.

Habitat.—Northumberland (Hodge).

Thyone elegans, Norman, 1868.

Habitat.—Shetland (Norman).

Excepting terminal plates in the pedicels and irregular cribiform plates in the tentacles, no deposits. Skin thin, very delicate. Pedicels numerous, scattered all over the body.

(?) *Thyone elongata* (*Thyonidium*), Ayres, 1851. *Orcula elongata*, Semper, 1868.

Habitat.—George's Bank (Ayres).

Thyone floccosa, Norman, 1864.

Habitat.—British Islands (Norman).

Genus 10. Stereoderma, Ayres, 1854.

Tentacles ten, two ventral smaller. Ambulacral appendages in the shape of pedicels, scattered irregularly over the body, but having a tendency to form a regular double-row in some parts of the trivium. Anus without teeth. Integument hard.

Stereoderma unisemita (*Anaperus*), Stimpson, 1854; Ayres, 1854; Selenka, 1867. *Cucumaria fusiformis*, Desor, 1851 (according to Verrill).

Calcareous ring, like that in *Psolus phantapus*, of ten simple pieces without posterior prolongations. Deposits—numerous crowded, thick, oval, smooth plates or rather buttons with four holes. Pedicels in want of terminal plate and nearly destitute of other deposits. The double row of pedicels is somewhat irregular, and placed on one side (according to Stimpson), or forms a well-defined line beneath (Ayres), or forms a double row along the right (or left) side of the body (Selenka).

Habitat.—Grand Bank and the coast of New England (Stimpson), Newfoundland and Massachusetts (Ayres), off Martha's Vineyard (Verrill), Nantucket (Desor), (?) Cape Palmas (Selenka).

Stereoderma murrayi, Bell, 1883.

The double row of pedicels only well developed in the anterior third of the body. Calcareous ring composed of numerous small plates, and carrying five long slender prolongations posteriorly. Deposits—numerous crowded, oval plates, with uneven or undulated margin, pierced with four holes and provided with lower or higher elevations round the margin; on the upper and under surfaces a half-ring is placed so as to form together a complete smaller ring, vertical in position to the plate itself.

Habitat.—Kurrachee (Bell).

I am almost convinced of the identity of the two forms *Stereoderma murrayi* and *Thyone sacellus*, which supposition is supported by the presence of the thick hard perisome with its unusually shaped deposits, the characteristic calcareous ring, &c. Some very unimportant differences exist:—*Stereoderma murrayi* is of a

white colour, possibly a result of the alcohol, with dark tentacles, and has only one Polian vesicle (madreporic canals unknown); *Thyone sacellus* is of a dark brown colour, has four Polian vesicles and twelve to twenty madreporic canals.

Stereoderma validum, Bell, 1884.

Habitat.—Port Jackson, North Dunbar Island, China Sea (Bell), between Ball's Head and Goat Island, Brisbane Water (Bell).

So far as I can find out from the description of Bell, this form cannot be anything else than a *Colochirus spinosus*, Quoy and Gaimard. Evidence of the correctness of this view is to be found in the form of the body, the presence of the characteristic conical denticulate prominences on each side of the ventral surface, the calcareous ring and even the general appearance of the calcareous deposits, though it may be observed that Bell does not mention anything about the presence of reticulate scales in the forms examined by him. Thus, if I am right in my supposition, *Stereoderma murrayi* is a *Thyone sacella* and *Stereoderma validum* a *Colochirus spinosus*. Finally, I feel convinced that further examinations will prove that *Stereoderma unisemita* may be referred to some already well-known genus, for instance *Thyone*.

Genus 11. Thyonidium, Düben and Koren, 1844.

Tentacles twenty, exceptionally fewer or more; five pairs of larger alternating with five pairs of smaller. Ambulacral appendages in the shape of pedicels, sometimes densely crowded, sometimes more thinly scattered; often an arrangement of them in rows distinguishable along the ambulacra.

I. Deposits of the body-wall itself, none, or present in the form of tables or plates in the neck portion alone.

Thyonidium drummondii (*Holothuria*), Thompson, 1840; Sars, 1861. *Cucumaria drummondii*, Forbes, 1841. *Cucumaria communis*, Forbes, 1841. (?) *Thyone portlockii*, Forbes, 1841. *Thyonidium commune*, Düben and Koren, 1844. *Holothuria fusus*, Œrsted, 1833 (according to Düben and Koren). *Thyonidium dübeni*, Norman, 1868.

Habitat.—Scandinavian coasts from the Sound to Lofoten (Sars, M'Andrew and Barrett, Danielssen, Düben and Koren, Lütken), British Islands (Thompson, Hodge, M'Intosh, Forbes, Norman).

(Mus. Holm.) Several specimens from the west coast of Sweden and Norway. So far as I can see, this species must be nearly allied to *Thyonidium pellucidum*,

and differs from it in some characters of more or less importance. Generally it seems to be larger, up to 160 mm. long, with closely placed pedicels, and often with the ambulacra indicated by a longitudinal furrow. It almost appears to be a rule, that the tentacles deviate somewhat from what is the typical condition in this genus. The calcareous ring is rather high, up to 17 mm. in the largest specimens; its radial pieces are excavated posteriorly so as to give rise to two short prolongations, but, considering that the ring in the specimens examined by me is much contracted and wrinkled, I am by no means sure of it, nor whether the pieces are simple or composed of some secondary parts, which sometimes seems to be the case. Excepting terminal plates in the pedicels, the body should be devoid of deposits, but in some specimens I have found tables in the cervical portion of the body. A single madreporic canal and two or three Polian vesicles. Norman says that the true *Thyonidium commune*, Forbes, differs from the Scandinavian form, described under the same name by Düben and Koren, in having the skin covered with tables which have a nearly circular disk with numerous perforations and a spire built up of four rods. Now my own researches show that the Scandinavian form also has deposits in the shape of tables, though principally in the cervical portion of the body. Norman does not point out in what respects his *Thyonidium commune* differs from *Thyonidium pellucidum*, nor does he say whether he has examined the types of Forbes and Thompson. It appears very probable that his species is only a *Thyonidium pellucidum*.

Thyonidium productum (*Duasmodactyla*), Ayres, 1854 and 1873; Stimpson, 1854. (?) *Orcula punctata*, Agassiz, 1852 (according to Stimpson).

Habitat.—East Port (Ayres), Grand Manan (Stimpson).

Deposits in the shape of "irregular perforated plates" present only in the cervical portion. Probably this species is not distinct from the preceding one.

II. Deposits of the body-wall itself absent, or present in greater or smaller number in the form of spinous rods.

Thyonidium molle (*Pattalus*), Selenka, 1868; Semper, 1868. *Thyonidium peruanum*, Semper, 1868. *Pattalus peruvianus*, Verrill, 1867 to 1871. *Anaperus peruanus*, Verrill, 1867 to 1871.

Tentacles varying from sixteen to twenty-one, sometimes typical; often, however, a typical in being of nearly equal size. Calcareous ring of ten simple pieces, the radial much higher than the interradial, and devoid, as it seems, of true posterior bifurcate prolongations. Deposits, when such are present, irregular, slightly spinous rods pierced by some holes.

Habitat.—Chili (Selenka, Semper, Ludwig), Peru (Selenka, Semper), Paita and Callao (Verrill).

(Mus. Holm.) One individual, 110 mm. long, dredged at Iquique. Colour brownish; tentacles darker. Tentacles nineteen, unequal, but in an irregular manner. Pedicels equally distributed all over the body. Excepting terminal plates in the pedicels, no deposits seem to be present. A single madreporic canal and numerous Polian vesicles. Each of the strong retractors appears as if it were composed of several distinct bands.

III. Deposits of the body-wall itself in the shape of tables.

1. *Calcareous ring of ten simple pieces, the radial not prolonged posteriorly.*

Thyonidium pellucidum (*Holothuria*), Fleming, 1828; Düben and Koren, 1844. *Cucumaria hyalina*, Forbes, 1841. *Pentacta pentactes*, Œrsted, 1833. *Thyonidium hyalinum*, Lütken, 1857. (?) *Thyonidium conchilegum*, Pourtalès, 1868 and 1869.

Tables rather scattered, excepting in the cervical portion of the body, where they are crowded, consisting of a regular, round, perforated disk with nine to twelve peripheral holes, and a spire built up of three to four rods terminating in spines and connected by a transverse beam near the top.

Habitat.—Scandinavian coasts from Finmark to the Sound (Sars, Storm, Düben and Koren, Ludwig, Lütken, Möbius and Bütschli, Danielssen, &c.), Arctic Sea north from Norway (Hoffmann), Mohn Bay (Heuglin), Spitzbergen (Ljungman), White Sea (Jarzynsky), British Islands (Hodge, Fleming, Forbes, Norman), North Atlantic Ocean, north of Shetland, at a depth of 1081 fathoms (Danielssen and Koren), Florida Reef (Pourtalès).

(Mus. Holm.). Several specimens from the west coast of Sweden. One fully typical individual may be described. Length, 55 mm. Body-wall white, slightly transparent, the five muscular bands being visible through it. Tentacles twenty, typical. Besides a double row of pedicels along the ambulacra, the interambulacra bear pedicels which, scattered without order on the dorsal surface, seem to be placed more or less distinctly in longitudinal rows on the ventral interambulacra. Anus surrounded by pedicels, distinguished from the true pedicels by having a very rich covering of irregular, reticulate, calcareous bodies, thus forming a transition to anal teeth. Even anteriorly on the body, the pedicels are supported by such irregularly perforated plates, though not so abundantly. On the rest of the body, the pedicels have, excepting terminal plates, none or a few supporting plates, but no rods. The tables, very thinly scattered, excepting at the cervical portion, where they are more aggregated, consist of a rather large perforated disk supporting a spire composed of three or four rods, one transverse beam, and terminating in several, sometimes as many as twelve

teeth. The disk is pierced with several—up to twelve—smaller peripheral holes around the large central ones, and has never, or at least very seldom, the margin smooth, but angular, or provided with small processes. A single Polian vesicle and madreporic canal. The genital organs attached far posteriorly, about 20 mm. behind the tentacles. Calcareous ring small, slender, about 3 mm. high, with the posterior margin wrinkled or angular, but devoid of posterior prolongations. The ten pieces of the ring are simple and slightly excavated posteriorly.

Thyonidium marionii (*Cucumaria*), von Marenzeller, 1878.

Habitat.—Mediterranean Sea (von Marenzeller, Marion, Ludwig).

In a letter von Marenzeller kindly informs me that his *Cucumaria marionii* is a *Thyonidium* with twenty tentacles, the smaller pairs having at first escaped his attention. Considering the smallness of the only individual hitherto obtained, it is very probably a young one, which also explains the absence of pedicels on the interambulacra; the species must be allied to the former, if not identical with it. Its deposits consist of tables with a rounded rhomboidal regularly perforated disk and a spire built up of only two rods. The radial pieces of the calcareous ring not so deeply excavated posteriorly as the interradial.

2. *Calcareous ring of ten simple or compound pieces, always with five radial posterior bifurcate prolongations, made up of several separate parts or joints.*

Thyonidium cebuense, Semper, 1868.

The posterior prolongations of the five radial pieces of the calcareous ring are composed of three separate pieces or joints. The five interradial pieces terminate anteriorly in a single conical point, the radial in four small ones.

Habitat.—Cebu (Semper).

The tables, not described but only figured by Semper, seem to consist of a roundish disk perforated with one central and several, about eight, peripheral holes and a spire of four rods.

Thyonidium magnum, Ludwig, 1882.

Calcareous ring "elongated posteriorly and spirally coiled." The tables consist of a disk perforated with four central and numerous much smaller peripheral holes; their spire is built up of two rods terminating in two to four points and strengthened by one transverse beam. Anteriorly, the ambulacra alone carry pedicels.

Habitat.—Amboina (Ludwig).

From the summary description of the calcareous ring, one cannot get an exact idea of its shape, whether it is composed of a large number of small pieces.

Thyonidium parvum, Ludwig, 1881 and 1882.

The ten pieces of the calcareous ring narrow, slender; the posterior two prolongations of the radial pieces composed of several separate parts or joints. The tables are smooth on the margin, consist of an oval disk, as a rule, pierced with eight larger peripheral and two smaller central holes, and a spire made up of two short rods connected at the top by a transverse beam, the top of the spire terminating in about eight spines.

Habitat.—Brazil (Ludwig).

The species is an exception to the rule in having only eighteen tentacles, nine larger and nine smaller.

Thyonidium occidentale, Ludwig, 1875.

The radial and interradial pieces of the calcareous ring simple, but between them a small calcareous wedge; the radial having their posterior prolongations short and composed of small particles. Tables consisting of a rather well-developed perforated disk with uneven dentate margin, and a spire reduced to four short spines united at their bases.

Habitat.—Surinam (Ludwig).

Thyonidium caudatum (*Thyone*), Hutton, 1872.

Body more tapering posteriorly so as to form a narrow caudal portion. Anal teeth very rudimentary, made up of a minute calcareous network. Tentacles twenty, typically arranged. Pedicels numerous all over the body, placed on low but distinct papilla-like warts, excepting at the caudal portion, where no warts are visible and the pedicels seem to form double rows on the ambulacra, the interambulacra being there naked. Calcareous ring, about 30 mm. long, is made up of a great number of small pieces, and terminates posteriorly in five slender bifurcate prolongations. Anteriorly the interradial parts of the ring terminate in a single conical top, the radial in four small teeth. Body-wall very rough from numerous larger or smaller tables; their disks are irregularly formed, smooth, elongated, fusiform, three-armed or angular with numerous holes, the four central of which are often larger; their spire is in the shape of a long simple conical spine, the base of which seems to be composed of two or more rods. Towards the top of the warts the spines become more solid and larger. Pedicels supported by such tables and a very rudimentary terminal plate. In the caudal portion of the body the disks of the tables are elongated, fusiform, and transverse in position. A single Polian vesicle and madreporic canal. Colour rusty brown; caudal portion and warts lighter yellowish. Length, 100 mm. or more. Very nearly allied to the following species.

(Mus. Holm). Two type specimens dredged at New Zealand, presented by Hutton.

IV. Deposits of the body-wall itself in the shape of simple plates.

Thyonidium japonicum, v. Marenzeller, 1881.

Calcareous ring almost like that in the preceding species. Deposits—crowded, irregular, perforated smooth plates of variable shape. The pedicels with tables, like those in the preceding species, consisting of an irregular curved disk supporting a long spine; in the pedicels of the anterior part of the body, even, irregular, perforated plates with rudimentary spire, and, besides, numerous small rods (incomplete rosettes) with the dilated ends perforated and branched.

Habitat.—Japan or China (von Marenzeller).

This species resembles the preceding one in general shape and other respects.

V. Deposits of the body-wall itself in the shape of rods.

Thyonidium schmeltzii, Ludwig, 1875.

One of the slightly enlarged ends of each of the rods is furnished with spines, the other is perforated; for the rest, the rods are smooth. The radial pieces of the calcareous ring prolonged into two slender posterior processes, the narrow interradial into one; all these processes composed of several separate pieces or joints.

Habitat.—Bowen and Gulf of St. Vincent (Ludwig), Warrior Reef and Torres Strait (Bell).

(Mus. Holm.) One very small individual, 12 mm. long, dredged at Pelew Islands. Colour brownish. It possesses the very characteristic deposits, which have the outwardly directed slightly enlarged end head-like and spinous, so that the rod resembles a club armed with nails.

The following species is too unsatisfactorily known and should be re-examined:—

Thyonidium ehlersi, Heller, 1868.

Deposits—tables composed of a round disk perforated with about eight peripheral holes and having the margin spinous; their central spire is made up of four rods.

Habitat.—Mediterranean Sea (Heller).

The species is probably very closely allied to *Thyonidium pellucidum*.

Thyonidium flavum, Greeff, 1882.

Deposits—very few disks composed of tightly crowded grains, and, also, scattered simple grains. Besides scattered pedicels in the interambulacra, more or less distinct double rows are present on the ambulacra.

Habitat.—Rolas (Greeff).

The species is not well known.

Genus 12. Orcula, Troschel, 1846.

Tentacles fifteen, five smaller alternating with ten larger. Ambulacral appendages in the shape of pedicels distributed over the ambulacra as well as interambulacra; an arrangement of them in rows seldom discernible on the ambulacra.

1. *Deposits in the body-wall itself absent.*

Orcula barthii, Troschel, 1846; Lutken, 1857; Duncan and Sladen, 1881.

Pedicels irregularly scattered. Calcareous ring of ten simple pieces, all bifurcate posteriorly, the radial terminating anteriorly in two points, the narrow interradial in one.

Habitat.—Greenland (Lütken, Norman, Duncan and Sladen), Labrador (Troschel) Sea of Kara (Stuxberg), (?) Spitzbergen (Ljungman).

Orcula limaconotus (*Cladolabes*), Brandt, 1835; Ludwig, 1881.

Habitat.—Boninsima (Brandt).

From the researches hitherto made, it is impossible to state whether this species is distinct from the preceding or not. The statement that *Orcula limaconotus* has several, up to nine, Polian vesicles, while *Orcula barthii* has only a single one, seems to be of little or no importance.

2. *Deposits in the body-wall itself present.*

Orcula tenera, Ludwig, 1875.

Pedicels irregularly scattered. Calcareous ring of ten simple pieces, "all" with two posterior slender prolongations composed of several separate pieces or joints. Deposits—very few tables and minute grains, the former composed of a roundish perforated disk and a spire built up of four (?) rods and one transverse beam.

Habitat.—Upolu in Navigator Islands (Ludwig).

Orcula hypsipyrga, von Marenzeller, 1881.

Pedicels irregularly scattered. Calcareous ring of ten simple pieces, the radial alone with two long slender posterior prolongations composed of several separate pieces or joints. The ends of these prolongations are united with those of the adjacent radial pieces. Deposits—tables consisting of a roundish disk with numerous holes, and a central spire built up of four to six rods and several transverse beams; the spire terminates in several spines.

Habitat.—Japan or China (von Marenzeller).

Orcula cucumiformis, Semper, 1868.

Larger pedicels in a double row along the ambulacra, and a few smaller scattered on the interambulacra. Calcareous ring of ten simple pieces, the radial with two posterior prolongations composed of several separate pieces or joints. Deposits—large scattered plates.

Habitat.—Cape York (Semper), Port Molle (Bell).

The following two species of *Orcula* are unsatisfactorily known :—

Orcula punctata, Selenka, 1867 and 1868.

Habitat.—Charleston (Selenka).

A very dubious form. Judging from the first description of Selenka, one must feel inclined to refer it to the northern form *Orcula barthii*, but lately in his "Nachtrag" Selenka declares *Orcula punctata* of Agassiz to be identical with *Thyonidium productum*, Ayres. Selenka, however, does not explain whether his *Orcula punctata*, described in 1867, represents the type of Agassiz mentioned by Selenka in 1868. Besides, it remains unexplained how *Thyonidium productum*, with twenty tentacles, and *Orcula punctata*, with fifteen tentacles, can be synonymous.

Orcula lapidifera (*Holothuria*), Lesueur, 1824; Semper, 1868. *Phyllophorus* (*?*) *lepadifera*, Verrill, 1867–1871.

Tentacles sixteen. Incomplete description. Possibly belonging to another genus.

Habitat.—St. Bartholomew (Lesueur).

Genus 13. Phyllophorus, Grube, 1840.

Tentacles forming two crowns, twelve to sixteen in the exterior and five to six in the interior. Ambulacral appendages almost without exception in the shape of pedicels, irregularly distributed all over the body.

I. Pedicels cylindrical, all of the same shape.

1. *Deposits in the shape of rods.*

Phyllophorus perspicillum (*Urodemas*), Selenka, 1867; Semper, 1868. *Orcula perspicillum*, Semper, 1868.

Fifteen larger tentacles in the exterior crown, and five smaller (?) in the interior Deposits—spectacle-like rods with a hole at each end, sometimes also with a

central hole, or with only one end perforated. Mouth stellate, closed by five groups of eight to ten papillæ in each. Calcareous ring of ten simple, flexible, spongy pieces, each bifurcated posteriorly; the pieces are not united with each other.

Habitat.—Sydney (Selenka), Port Denison and Port Stephens (Bell).

The relative size of the tentacles and their position are not fully clear, wherefore further investigations are required to prove whether this species really belongs to the genus in question or is to be referred to *Orcula*, in which case the diagnosis of the latter genus must be changed.

Phyllophorus ehrenbergii (*Urodemas*), Selenka, 1868; Semper, 1868.

Fifteen larger tentacles in the outer crown, and five smaller in the inner. Deposits—numerous spinous, not perforated rods, arranged three and three; one always thicker and longer than the other two. Calcareous ring, as it seems, of ten simple pieces, the radial considerably larger and carrying two posterior prolongations, which are simple and not divided into joints.

Habitat.—Red Sea (Selenka).

Phyllophorus frauenfeldi, Ludwig, 1875. *Phyllophorus*, n. sp., Semper, 1868.

Fifteen larger tentacles in the outer crown, and five smaller in the inner. Deposits like those in the preceding species, consisting of rods with four simple or bifurcate spines round the middle and four simple ones at each end. Calcareous ring of ten simple pieces, the radial slightly larger and bearing posteriorly two slender prolongations divided into joints.

Habitat.—Red Sea (Ludwig, Semper).

Semper also figures a rosette-shaped body found in the perisome, but there is nothing mentioned about such in the description of Ludwig; he only refers to the figures given by Semper. For my own part I cannot refrain from supposing that *Phyllophorus ehrenbergii* and *Phyllophorus frauenfeldi* are very nearly related, and that they may prove to be identical.

2. *Deposits—plates either of a more common shape, or button-like, or rosette-shaped.*

Phyllophorus dobsoni, Bell, 1883.

Twelve tentacles in the exterior crown and six in the interior. Pedicels irregularly distributed, but scarce or absent in the central portion of the ventral surface. Deposits—numerous thick, discoidal bodies, with serrate margin, with a few (about four) small perforations and a number of minute conical knobs.

Calcareous ring of ten simple pieces, the stout radial pieces devoid of true processes posteriorly.

Habitat.—Bay of Honduras (Bell).

Bell speaks of "short and feeble, backwardly directed processes" on the radial pieces of the calcareous ring, but, according to his drawings, the posterior margin of the named pieces is slightly uneven but devoid of processes. The deposits bear some resemblance to buttons.

Phyllophorus proteus, Bell, 1884.

Deposits—more or less four-sided, smooth plates with four larger holes and several, about four pairs, of processes in the margin. The pedicels strengthened with roundish disks resembling agglomerations of minute grains. Calcareous ring of ten simple pieces, all deeply excavated anteriorly; the radial ones obtuse, the interradial pointed posteriorly.

Habitat.—Port Molle, Clairmont and Thursday Islands, Alert Island (Bell).

Nothing is known about the arrangement of the tentacles, hence there may be some doubt whether the species really belongs to this genus.

Phyllophorus gracilis (*Urodemas*), Selenka, 1868; Semper, 1868.

Fifteen larger external tentacles, and five smaller internal. Deposits—scattered, irregular, knobbed, perforated rosette-shaped plates. Calcareous ring of ten simple pieces, the interradial ones small, the larger radial with two posterior slender appendages articulating with the main pieces.

Habitat.—Red Sea (Selenka).

A re-examination and careful comparison of the three species living in the Red Sea appear to be necessary.

3. *Deposits—tables, sometimes with the disk more or less reduced.*

Phyllophorus urna, Grube, 1840; Sars, 1857. *Holothuria penicillus*, Delle Chiaje, 1828. *Phyllophorus penicillus*, Delle Chiaje, 1841.

Tentacles varying, twelve to sixteen larger in the exterior crown and five smaller in the interior crown. Deposits—very thinly scattered tables, composed of a roundish perforated disk, with about eight peripheral holes, and a spire built up of four rods and one transverse beam; and minute grains. Calcareous ring of ten simple pieces, the radial with two long posterior prolongations.

Habitat.—Mediterranean Sea (Grube, Sars, Ludwig, &c.).

(Mus. Holm.) Two large specimens from Naples and four from Cagliari. Excepting rods and terminal plates in the pedicels, and some minute granular oval bodies, I detected scarcely a single deposit. I counted sixteen larger external and four smaller internal tentacles. According to Sars, the older specimens are almost devoid of tables, and possess only some grains or granular bodies.

Phyllophorus holothurioides, Ludwig, 1875.

Tentacles eighteen, thirteen exterior, two ventral of which are much smaller, and five small interior. Deposits—tables consisting of an irregular, perforated disk with uneven, spinous margin, and a spire reduced to four or six spines. Calcareous ring of ten simple pieces, the radial ones larger and provided with two slender posterior prolongations, each divided into joints.

Habitat.—(?).

II. Ambulacral appendages of two kinds: smaller cylindrical pedicels only on the middle of the ventral surface, and larger conical granular papillæ or warts with pedicels on the rest of the body.

Phyllophorus granulatus (*Psolus*), Grube, 1840; Sars, 1857. *Hemicrepis granulatus*, Müller, 1853.

Tentacles twelve to thirteen in the exterior crown, and six smaller in the interior. Deposits—nearly absent on the middle portion of the ventral surface, but very closely crowded on the rest of the body, especially in the papillæ; they consist of irregular, perforated smooth plates and large, round, very thick reticulate scale-like ones. Calcareous ring of ten simple pieces, the radial with two slender undivided posterior prolongations.

Habitat.—Mediterranean Sea (Grube, Sars, Ludwig, &c.).

The following two species are incompletely known and need to be re-examined:—

Phyllophorus tenuis, Haacke, 1880; Ludwig, 1883.

Habitat.—Mauritius (Haacke, Ludwig).

Ludwig having seen the type-specimen, states that it is too defective to be re-examined. He does not seem to be sure whether it is a *Phyllophorus*.

Phyllophorus fusus (*Holothuria*), Delle Chiaje, 1828 and 1841.

Habitat.—Mediterranean Sea (Delle Chiaje).

Family IV. Rhopalodinidæ.[1]

Dorsal interradial space or bivium highly abbreviated and reduced, ventral surface enormously enlarged, consequently the body has a bottle-like appearance with mouth and anus placed close together in the same narrow proboscis-like pole

[1] Semper referred this peculiar Holothurid to a new class among the Echinodermata, which he called "*Diplostomidea*."

of the body; thus the anal and oral poles have been approximated side by side. Tentacles ten, pinnate. Genital pore on the very minute space between mouth and anus. Five double rows of pedicels along the middle portion of the body (viz., the enlarged part of the bottle); in consequence of the peculiar shape of the body the pedicels give the impression of being placed in ten double rows confluent at the larger rounded extremity.

Genus 1. Rhopalodina, Gray, 1853.

Rhopalodina lageniformis, Gray, 1853; Semper, 1868; Ludwig, 1877.

Body-wall stiff, from irregular, perforated plates and comparatively few tables, with a large perforated disk and a rudimentary spire. Four respiratory-trees. Anus with ten radial papillæ and five interradial teeth. Calcareous ring composed of ten irregular pieces. Anal portion of the intestine surrounded by ten regular pieces.

Habitat.—Congo coast (Gray).

Family Aspidochirotæ.

Genus *Pælopatides*, n. gen.

Body more or less distinctly depressed, with a rather considerable brim surrounding it not only on the sides, but also round the extremities. Tentacles nineteen or twenty, of the shape common in Aspidochirotæ. Mouth ventral. Anus dorsal or subdorsal. Ambulacral appendages—pedicels and processes (=papillæ). The pedicels form a double row along the odd ambulacrum, excepting anteriorly where they are absent. The processes form a simple row round the margin of the brim which surrounds the body, and are, besides, scattered along each of the two dorsal ambulacra. Interambulacra naked. Two bundles of genital tubes present.

Pælopatides confundens, n. sp. (Pl. IX. fig. 7; Pl. X. figs. 1, 7).

Body very much flattened and depressed, elongated, almost equally broad or slightly narrower posteriorly, with the anterior and posterior extremities obtuse and rounded. Mouth completely ventral in position, surrounded by nineteen or twenty (?) retracted tentacles. Anus completely dorsal. The brim surrounding the body very considerable, and carrying on its margin a series of rounded low protuberances, which, especially round the anterior extremity of the body, are more prominent and pointed, almost

presenting the aspect of lobes. Each of these lobes or protuberances communicates with the water-vascular system. The odd ambulacrum with a double row of fully retractile pedicels, excepting in its anterior third which is naked. Each of the dorsal ambulacra with a simple row of thinly scattered, short, conical processes or papillæ. Calcareous deposits dissolved. Colour in alcohol, light brownish inclining to violet; in some specimens it is darker, nearly black on the ventral surface, especially along its middle. Length of the largest specimen about 300 mm., breadth at the middle of the body about 110 mm., height 20 to 25 mm. or less.

Habitat.—Station 298, November 17, 1875; lat. 34° 7′ S., long. 73° 56′ W.; depth, 2225 fathoms; bottom temperature, 35°·6; blue mud; three specimens. Station 299, December 14, 1875; lat. 33° 31′ S., long. 74° 43′ W.; depth, 2160 fathoms; bottom temperature, 35°·2; blue mud; a single very macerated individual. Station 300, December 17, 1875; lat. 33° 42′ S., long. 78° 18′ W.; depth, 1375 fathoms; bottom temperature, 35°·5; Globigerina ooze; six individuals.

The external aspect of this species bears a great resemblance to that of *Euphronides depressa*, though it is devoid of any larger odd dorsal process. In the largest specimen the breadth of the brim at the middle of the body is about 30 mm., and its anterior lobes are almost triangular with the base considerably broad. In the other specimens the anterior lobes are larger, more rounded, conical, and measuring up to 8 mm. in length, while the protuberances along the sides of the body are commonly less prominent, and mostly present themselves under the shape of small swellings in the margin of the brim. The dorsal processes do not seem to attain the same size as the lobes of the brim, but are commonly smaller. In one individual, 250 mm. long, dredged at Station 298 the number of ambulacral appendages was as follows:—about thirty pedicels arranged in a double row on the odd ambulacrum, about seventy-five closely placed lobes or protuberances forming a simple row round the margin of the body-brim, and fourteen or fifteen processes along each dorsal ambulacrum. In the largest specimen the dorsal processes are completely retracted and only visible as very flat almost inconspicuous warts with a small pit in the middle. The tentacles seem to be twenty, though I am not fully convinced of the accuracy of this number. In the largest individual the oral aperture is situated on the ventral surface about 35 mm. behind the anterior extremity of the body, and the anus lies on the dorsal surface about 13 mm. in front of the posterior extremity of the body. In one specimen some small warts surround the anal aperture.

The calcareous ring seems to be absent, or, more probably, dissolved by some impurity in the alcohol. The madreporic canal is not fully known. In the largest specimen two ventral Polian vesicles are present, one of which has a length of 145 mm., while the other only measures 90 mm. A thin bundle of genital tubes, several times branched, is situated on each side of the dorsal mesentery, and the common efferent

duct takes its beginning in the largest specimen at about 80 mm. behind the mouth. In all the specimens examined by me, excepting the largest one dredged at Station 298, the alimentary canal sends out anteriorly a large diverticulum, which, in an individual 160 mm. long, has a length of about 50 mm., and is situated about 50 mm. behind the water-vascular ring. It is held in a proper position by the mesentery to which it is attached. The cloacal dilatation of the intestine is considerable; the respiratory-trees are well developed, and both its branches run out from a common base; the left tree is shorter but more branched, its ramifications being in communication with the plexus of pseudhæmal vessels. The right tree attains almost the length of the body itself. At the base of these respiratory organs, a smaller bundle is often present. The longitudinal muscles are composed of two bands.

In the specimens obtained at Station 298 the calcareous deposits are totally absent, probably owing to some impurity in the alcohol. In the specimen from Station 299 some very fragmentary, irregular, three- or four-armed spicules are present, which commonly seem to bear an outwardly directed process, but I only found these deposits in the dorsal processes (Pl. X. fig. 1), and they were evidently in a state of solution. The integument is soft, thin, and pliable.

The specimen dredged at Station 299, measuring in length 235 mm. and in breadth about 70 mm., is much more macerated than those brought home from the other Station. I am by no means fully convinced of its identity with the latter specimens, but they present an obvious resemblance. Considering that the deposits are dissolved and the bodies themselves are very deformed and macerated, it is impossible to decide whether they are representatives of the same species or not. The individual from Station 299 has the Polian vesicles much shorter, only 30 mm. long, and the two thin bundles of reproductive organs have the tubes narrow and slender and up to four times (or more) dichotomously branched.

Having finished the above description founded on the specimens from Stations 298 and 299, I obtained the forms brought home from Station 300, in consequence of which some additions are necessary. These specimens, kept in purer alcohol, are less macerated, and their colour is dark violet, sometimes almost black; the middle part of the back commonly presents a lighter colour. The largest specimen measures in length slightly more than 300 mm., and its tentacles are nineteen. Though the calcareous ring is absent, the other deposits are not all spoiled. The general shape of the deposits of the perisome seems to be three-armed, with the ends of the arms slightly branched or pierced by a hole; the centre of each such deposit carries a strong vertical column, the flattened and dilated end of which is provided with long spines or processes (Pl. X. fig. 7). By reason of these closely placed spinous columns the surface of the perisome is rather rough. However, even in these specimens the greater part of the deposits of the body-wall is dissolved. Lately I have got four other specimens provided with twenty tentacles from

the same Station, 300, which are probably identical with the former; one of them, comparatively well preserved, has about thirteen processes along each dorsal ambulacrum, of which one pair, situated slightly in front of the middle of the body, has a length of 12 mm., while all the remaining ones are minute and wart-like. This specimen also is provided with the large diverticulum characteristic of the species in question.

It is very probable that some of the specimens, especially of those obtained at Station 298, which are referred to *Pælopatides confundens*, belong to another species, but it seems almost impossible to state this confidently, considering that in most of the specimens all deposits are destroyed. As to their outer shape, I cannot find any marked difference, if there even exist some small variations.

Pelopatides aspera, n. sp. (Pl. X. fig. 13).

Body depressed, oval, or of almost equal breadth throughout, more obtusely rounded anteriorly than posteriorly. Mouth completely ventral. Anus subdorsal. Tentacles twenty. A rather broad brim surrounds the body, in the margin of which a row of small prominences is situated. The anterior part of the brim, surrounding the anterior extremity of the body, is much thinner than the rest, and bears some resemblance to a large transverse lobe. The ventral odd ambulacrum with a few pairs of pedicels only in its posterior part. The two dorsal ambulacra with a few very minute, slender, retractile processes. Body-wall thick, soft and pliable, containing numerous four-armed bodies with the arms curved and spinous, and with a long spinous central column; these spines are minute, and arranged in transverse bands or rings. Colour in alcohol dark brownish-violet. Length in contracted state 125 mm., breadth 75 mm.

Habitat.—Station 207, January 16, 1875; lat. 12° 21′ N., long. 122° 15′ E.; depth, 700 fathoms; bottom temperature, 51°·6; blue mud; a single individual.

The anterior thin lobe-like part of the brim, which constitutes the foremost portion of the body, does not seem to be in immediate continuation with the rest of the brim, which is formed by the very thick sides of the body; the margin itself of this latter brim, in which the small processes or prominences are found, is of course much thinner, and may strictly be considered as the true brim. The processes of the brim resemble small, low conical elevations, or, as is the case in the anterior lobe-like brim, more elongated narrow papillæ. Only the posterior third of the odd ambulacrum carries some small pedicels, seven in number, arranged in a double row; besides, two other pedicels are visible posteriorly on the left ventral interambulacrum. The dorsal ambulacral appendages seem to be few, very fine and thread-like, so that they are scarcely visible to the naked eye. So far as I can find, the number of tentacles is twenty, but some are less developed than the rest.

All the internal organs are destroyed excepting the respiratory trees, which seem to

be well developed. The longitudinal muscles each consist of two bands. The arms of the deposits of the body-wall (Pl. X. fig. 13) are more or less strongly curved inwards, and have a length of up to 0·3 mm.; their ends are slightly enlarged and spinous. The central, outwardly directed column has a length of about 0·24 mm. Both this column and the arms are remarkable in that the minute spines are mostly arranged in transverse bands or rings; thus I counted five such rings in the central column and five to six or more in the arms. Sometimes the spines seem to be more irregularly scattered. The pedicels are strengthened by the same kind of deposits, though they are smaller, and also by some small simple spicules; no terminal plates seem to be present.

(?) *Pælopatides appendiculata*, n. sp.

Station 235, June 4, 1875; lat. 34° 7′ N., long. 138° 0′ E.; depth, 565 fathoms; bottom temperature, 38°·1; green mud; three specimens.

Considering that all the three specimens brought home from the above-mentioned Station are rather macerated and defective, and that the calcareous ring and the deposits of the perisome are totally destroyed, I think it best to give a description without any previous diagnosis.

The largest and best preserved specimen measures in length about 200 mm. The body is elongated and cylindrical, equally rounded anteriorly and posteriorly. The mouth is almost terminal, though ventral in position. The anus is dorsal. Round the sides of the body, as well as round its anterior and posterior ends, the body-wall seems to be slightly thicker, but, as far as I can find, no true brim is discernible. Numerous closely placed conical and flexible processes run out from this thicker part of the body, and they are so arranged as to form a simple row round the body. The largest of these processes are about 10 or 15 mm. long. The dorsal surface also carries processes, but from the defective state of the specimens it is impossible to distinguish their size and distribution. However, they seem to be few in number, arranged only on the ambulacra in a simple row on each, and a pair of them, situated slightly in front of the middle of the body, is larger than the rest. A double row of pedicels is situated along the odd ventral ambulacrum, which appears to be naked only anteriorly. Thus all the interambulacra seem to be in want of ambulacral appendages. The tentacles are twenty, and consist of a small disk with about six digits or processes. The body-wall is very soft, spongy, thick, and swollen, probably from the influence of some acid in the alcohol. The colour in alcohol is sea-green, excepting along the middle of the ventral surface, where it is darkish brown, but probably the original colour is spoiled.

A single Polian vesicle is present, 35 to 40 mm. long. The reproductive organs consist of a bundle of tubes on each side of the dorsal mesentery, each genital tube being branched three to five times. The most anteriorly situated tubes, which constitute each

bundle, are comparatively small, while the posterior ones have a length of about 6 mm. The specimen examined being a female, the genital tubes are present in the shape of strings of pearls. The intestinal tube is spoiled, but a very well-developed respiratory-tree is left, which has the length of the body itself and is attached to the right dorsal interambulacrum by means of numerous threads. This tree consists of a wide tube and numerous bush-like branches. Probably the left tree has been thrown away together with the intestinal canal.

Genus *Stichopus*, Brandt, 1835.

Stichopus möbii, Semper, 1868 (Pl. IX. fig. 1).

Habitat.—Bermudas; one specimen.

The single specimen brought home by the Challenger Expedition is rather deformed and compressed; however, there seems to be but little doubt of its identity with the species of Semper. Length, 135 mm. Tentacles eighteen. The dorsal ambulacral appendages small, and scattered without order; those situated along the sides of the body seem to be slightly larger. The tentacles are withdrawn into the body, and the anterior aperture is surrounded by a crown of small papillæ.

In addition to the smaller tables (Pl. IX. fig. 1, *a*, *b*, *c*), measuring about 0·04 mm. in height, and provided with up to twenty teeth in the top of the spire, I have found some scattered larger ones (Pl. IX. fig. 1, *d*, *e*), which are not mentioned by Semper; probably they have escaped his attention. The differences between these two kinds of tables will be best understood from the figures. The smaller tables are more solid, and their disks measure about 0·04 mm. in diameter. The larger tables have a height of 0·06 mm. and about the same in diameter; their spire has a rounded and finely spinous top. The transverse rows of the pedicels (Pl. IX. fig. 1, *f*) have a length of 0·38 mm. The C-shaped (Pl. IX. fig. 1, *g*) bodies are often about 0·052 mm. long, but they vary much in size and shape.

Stichopus chloronotus, Brandt, 1835 (Pl. VII. fig. 6).

Habitat.—Tongatabu (Friendly Islands); a single specimen. Fiji Islands; five specimens.

Colour, olive-brown. Tentacles twenty. Mouth surrounded by a crown of papillæ. Dorsal ambulacral appendages in the shape of conical warts or protuberances distributed in a double alternating row along each side of the body as well as along the dorsal ambulacra; their arrangement in a double row is more distinct in the dorsal ambulacra than on the sides. The odd interambulacrum and those of the sides of the body are naked. The ventral pedicels are crowded, and their arrangement in longitudinal series

not very clear in the contracted and wrinkled specimens which I have had at my disposal. A single madreporic canal and three Polian vesicles present. Deposits—numerous C-shaped bodies (Pl. VII. fig. 6, *e*); tables (Pl. VII. fig. 6, *a*, *b*, *c*); besides, I have found a very few incomplete rosettes or dichotomously branched bodies (Pl. VII. fig. 6, *d*) which were absent in the typical specimens examined by Selenka and others. Concerning the shape of the deposits, I refer to the plates. The pedicels contain spinous rods which are mostly enlarged and perforated at their middle (Pl. VII. fig. 6, *g*). The dorsal appendages are also strengthened by numerous curved, simple or branched rods. The presence of the rosettes is the only difference from the typical forms; possibly they are peculiar to the forms from the above-mentioned stations—or they have escaped my predecessors through their scarcity.

Stichopus japonicus, Selenka, 1867 (?) (Pl. VII. fig. 3).

Habitat.—Japan, March 14, 1875; from pools; a single specimen.

The specimen does not quite agree with the descriptions of Selenka and von Marenzeller, but, nevertheless, I do not think it possible to refer it to any other species. The dorsal surface is dark reddish-brown, while the ventral surface is light. A simple row of seven to eight rather considerable conical prominences is situated along each side of the body, corresponding to the lateral ventral ambulacra, and another more irregular, double, or alternating row of equally large prominences is present along each dorsal ambulacrum. Small scattered papillæ are also to be found all over the dorsal surface. The ventral pedicels are much more crowded, but from the contracted condition of the perisome it is impossible to distinguish any arrangement of them in longitudinal series. From the inside of the body, on the contrary, it is easy enough to find a longitudinal space along the middle of the two ventral interambulacra free from pedicels. So far my observations seem to agree with those of Selenka and von Marenzeller. It is especially with regard to the deposits that disagreements exist, which render the correctness of my determination dubious.

The tables have the same shape as described by von Marenzeller (Pl. VII. fig. 3, *a*, *b*), but, besides these, I find a great quantity of small rounded or oval perforated plates (Pl. VII. fig. 3, *c*), some of which bear a certain resemblance to buttons. Selenka also described such bodies under the name of "Hemmungsbildungen." The pedicels possess, besides terminal plates, tables and the above named small plates, elongated button-like plates with two longitudinal rows of holes (Pl. VII. fig. 3, *d*); these plates, which have a length of about 0·15 mm. or more, are often somewhat deformed, rod-like. The papillæ, on the contrary, are characterised not only by such elongated plates, but also by curved spinous transverse rods (Pl. VII. fig. 3, *e*). Neither Selenka nor von Marenzeller mentioned anything about these deposits which I find in the dorsal papillæ.

Stichopus japonicus, var. *typicus*, nov. (Pl. VIII. fig. 2).

Habitat.—Japan, May 1875 ; two specimens.

The two specimens brought home by the Challenger Expedition have each a length of 220 mm., thus being much larger than the previously known forms described by Selenka and von Marenzeller. In consequence of the existence of some differences I prefer for the present to consider the Challenger specimens as a variety, though it is most probable that they represent the older and more fully developed forms of *Stichopus japonicus*, a supposition confirmed not only from the greater size, but also from the presence of well-developed genital bundles on each side of the dorsal mesentery; neither Selenka nor von Marenzeller found the reproductive organs developed.

The colour is reddish or brownish-grey, lighter on the ventral surface. The tops of the dorsal papillæ are light, in one individual almost whitish. Even the sucking-disks of the pedicels are light coloured. The largest processes attain a length of about 15 mm., and a breadth at the base of 8 mm. or more, and their arrangement agrees with that described by von Marenzeller. The small dorsal papillæ, scattered among the larger, seem to be rather numerous.

The rather long, slender genital tubes are several times branched, and form two bundles not very thick, one on each side of the dorsal mesentery. The Cuvierian organs seem to be absent. A single Polian vesicle and madreporic canal are present. The calcareous ring is peculiar not only in that the ventral interradial pieces are smaller than the dorsal, but especially in that the dorsal radial pieces (Pl. VIII. fig 2, *f*) are provided with rather considerable posterior prolongations, which, on the contrary, is not the case with the ventral radial pieces (Pl. VIII. fig. 2, *g*). Thus, when examining only the ventral part of the calcareous ring, one cannot get any exact idea of its true conformation. *Stichopus japonicus*, var. *typicus*, is not the only form that I have seen with such an asymmetrical calcareous ring.

The calcareous deposits consist of tables alone, but comparatively few of them are fully developed, by far the greater part presenting themselves under the shape of perforated disks with the margin very uneven or spinous, and with no spine or a very poorly developed one (Pl. VIII. fig. 2, *d*). The largest of these disks measure about 0·05 mm. in diameter. The rare complete tables are smaller and larger, composed of a rounded perforated disk with smooth margin and a spire built up of mostly four rods and one or more transverse beams (Pl. VIII. fig. 2, *a*, *b*, *c*). The spire often terminates in four longer or shorter teeth. The larger tables measure about 0·05 mm. in height, and their disks have a diameter of 0·05 mm. There are also to be found tables with a spire composed of only two rods. The dorsal papillæ are strengthened by numerous smooth or spinous, curved rods, and, besides, by elongated, bilateral, perforated, button-like plates with the holes arranged in two longitudinal rows (Pl. VIII. fig. 2, *e*). The pedicels are

almost destitute of such plates and rods, or provided with very few. I also found two or three smooth buttons with six holes, but these probably belong to another animal.

The specimens of *Stichopus japonicus* described as types seem to have the disks of the incomplete tables smooth.

Stichopus haytiensis, Semper, 1868 (?) (Pl. VII. fig. 5).

Habitat.—Bermuda; a single incomplete individual.

Having examined only a single specimen, which is very contracted and deformed, I cannot be fully certain of the exactness of my determination. The ventral pedicels are disposed in three longitudinal series; Semper mentions five such series. The arrangement of the dorsal ambulacral appendages is not fully known; I only find a row of larger conical prominences along each side of the body, but I must leave it undecided whether the remaining prominences (=papillæ) are disposed in rows or not. The tentacles are twenty, of unequal size. The colour is darkish chocolate-brown, lighter on the ventral surface. All the internal organs are spoiled, excepting the calcareous ring, which is peculiar in having its radial pieces bifurcated posteriorly; the respective pieces do not seem to be of equal size. The calcareous deposits consist of very thinly scattered C-shaped bodies, about 0·05 mm. long (Pl. VII. fig. 5, *f*), and very numerous crowded tables (Pl. VII. fig. 5, *a*, *b*, *c*), with the disk mostly pierced by a larger central hole surrounded by a ring of smaller holes; the margins of these disks are often more or less uneven, but never spinous. The spire of the tables has a single transverse beam, and terminates regularly in twelve teeth or spines; sometimes, however, the top of the spire is provided with more spines. The tables are about 0·044 mm. high. In the pedicels and dorsal processes the disks of the tables are often reduced to a simple calcareous ring, combining the bases of the four rods which constitute the spire (Pl. VII. fig. 5, *d*). The ventral as well as dorsal ambulacral appendages are strengthened by numerous transverse, simple, or branched irregular rods. Semper does not mention anything about the characteristic shape of the calcareous ring (Pl. VII. fig. 5, *e*) which is present in the animal brought home from Bermuda, wherefore it is possible that this form, on account of this peculiarity, represents a new variety.

Stichopus variegatus, Semper, 1868 (Pl. VII. fig. 7).

Habitat.—Zebu Reefs (Philippine Islands); a single specimen.

The very contracted and deformed individual is doubtless a young form, its length in the contracted state being only about 120 mm. The colour is yellowish-grey inclining to brownish, lighter on the ventral surface. There are twenty yellowish tentacles. The pedicels are disposed in three distinct series, the two lateral composed of

two or three rows, the middle one of five or six. The dorsal papillæ are small and fully retracted, and therefore their true disposition is not discernible in the very contracted and wrinkled specimen. A single madreporic canal and Polian vesicle are present. The calcareous ring is like that figured by Semper. The forms of the deposits are shown in the figures, and seem to agree with those of Semper. The C-shaped bodies (Pl. VII. fig. 7, *e*) are numerous and of very unequal size, some being small, others large; usually their length reaches as much as 0·06 mm. The rosettes or dichotomously branched bodies (Pl. VII. fig. 7, *d*) are small, measuring about 0·3 mm., and the tables (Pl. VII. figs. 7, *a*, *b*, *c*) have a height of about 0·032 mm. The pedicels are strengthened by spinous rods (Pl. VII. fig. 7, *f*), commonly enlarged and perforated at the middle, and even the papillæ are provided with numerous crowded, slightly curved, spinous rods.

Stichopus challengeri, n. sp. (Pl. X. fig. 21).

Body elongated, cylindrical, more tapered posteriorly than anteriorly, slightly flattened. Mouth ventral, surrounded by nineteen tentacles. Anus terminal. Ventral surface with three longitudinal series of cylindrical pedicels, the two lateral series composed of two rows, the middle broader one of two to four rows. Dorsal surface with elongated, conical processes scattered over the ambulacra and interambulacra; an arrangement of them in rows is scarcely to be found elsewhere than along the sides of the body, where they evidently belong to the lateral ventral ambulacra. Body-wall thin and pliable, with scattered deposits, composed of three to four arms and a central column terminating in a few small teeth; the arms are mostly bifurcate at the ends, but sometimes perforated. As a rule, the deposits are not very symmetrical. The pedicels and processes are supported by numerous spinous, slightly curved rods, and the former bear a well-developed terminal plate. Colour in alcohol, grey inclining to violet; tentacles yellowish. Length, 160 mm. or more.

Habitat.—Station 148A, January 3, 1874; lat. 46° 53′ S., long. 51° 52′ E.; depth, 550 fathoms; hard ground, gravel, shells; a single slightly macerated specimen.

The dorsal processes have a length of about 7 mm.; the largest are to be found round the anterior extremity of the body. Excepting four-armed bodies like those in the body-wall itself, but considerably larger and with the enlarged ends of the arms perforated, the processes contain numerous simple, or, more seldom, branched spinous spicules, which often have the ends perforated by a small hole. The top of the processes is supported by small irregularly branched and spinous spicules forming a kind of terminal plate. The cylindrical, wide pedicels, about 5 mm. long, form an alternating double row along each side of the ventral surface, and, also, a median series, composed, apparently, of about four rows of pedicels on the posterior half of

the body; anteriorly, the odd ambulacrum carries only two rows of pedicels. The pedicels have a well-developed terminal plate, numerous spinous, curved rods, often with the ends perforated, and, besides, a number of four- or three-armed deposits. The form of the deposits of the body-wall (Pl. X. fig. 21) will be best understood from the figures; their diameter is about 0·056 mm., while the central column has a length of about 0·08 mm. In the dorsal processes the deposits often attain a diameter of about 0·28 mm. The central column mostly terminates in three or four short tops, and it is often, especially in the dorsal processes, pierced with one or two holes near the free end; a true "spire" is never to be found. I have observed two C-shaped deposits, but they probably belong to another animal.

The calcareous ring is well developed, of the usual shape, without posterior prolongations. Two Polian vesicles are present, of which one has a length of 25 mm., while the other is rudimentary. The single dorsal madreporic canal is attached to the dorsal mesentery. A bundle of very long, slender genital tubes, two or three times dichotomously branched, is situated on each side of the dorsal mesentery. A single respiratory tree with two branches is present, and does not seem to have any intimate connection with the pseudhæmal vessels.

Stichopus (*?*) *torvus*, n. sp. (Pl. X. figs. 2–4).

Body cylindrical, with the ventral surface considerably more flattened than the strongly convex dorsal surface; along the line of junction of the two surfaces the body-wall is slightly thickened. Mouth and anus almost terminal, slightly ventral in position. Tentacles twenty. The dorsal surface and the lateral parts of the ventral surface covered with conical processes, of which those forming a row along the transition between the upper and lower surfaces of the body attain a more considerable size and often bear branches; the processes decrease slightly in size towards the middle of the back. The rest of the ventral surface is covered with small crowded ambulacral appendages, the form and shape of which are unknown. Calcareous deposits totally absent, probably dissolved (?). Colour in alcohol, dirty brown, speckled with lighter spots on the back; tentacles, mouth, and a space round the mouth almost black. Length about 210 mm.

Habitat.—Station 300, December 17, 1875; lat. 33° 42′ S., long. 78° 18′ W.; depth, 1375 fathoms; bottom temperature, 35°·5; Globigerina ooze; a single specimen.

The individual I have had at my disposal is so much macerated, wrinkled, and covered with foreign matters as to make a detailed examination impossible. Some impurity in the alcohol has also probably dissolved the calcareous substances in the perisome, in consequence of which it is impossible to state the true shape of the ventral ambulacral appendages; they were either true cylindrical pedicels provided with sucking-

disks and terminal plates, or they are to be referred to papillæ. They resemble small rounded warts, which, to judge from the ampullæ visible on the inside of the body-wall, are very crowded and form a broad series along the middle of the ventral surface. Even the processes, which are to be found on the rest of the body, have such ampullæ, and these are larger when they communicate with the larger processes along the sides of the body. The largest processes, which attain a length of about 20 mm., are mostly of very great dimensions at the base, and terminate in two to four processes, thus presenting the aspect of being branched (Pl. X. fig. 3). The rounded terminal disk of the tentacles carries as many as twelve small processes in its margin.

The calcareous ring (Pl. X. fig. 2) is strongly developed, without posterior prolongations. A single ventral Polian vesicle, 40 mm. long, is present. Madreporic canal unknown. The reproductive organs form a close bundle on each side of the dorsal mesentery, each bundle being composed of a number of short, slightly branched, oval sacs or tubes (Pl. X. fig. 4). The longitudinal muscular bands seem to be simple, though their middle parts do not attain any considerable thickness. The right respiratory tree alone is developed.

The external appearance as well as the internal organisation remind one of a *Stichopus*, and therefore I prefer for the present to refer the above described species to that genus. There exist, however, such important differences in the shape and arrangement of the ventral ambulacral appendages that one might be fully justified in considering it a type of a new genus; but, considering that the specimen at my disposal is rather deformed, so that a part of the ventral ambulacral appendages are indistinguishable, and that all the deposits are spoiled, I think it best to leave that to the future.

Stichopus moseleyi, n. sp. (Pl. X. figs. 19, 20).

Body elongated, almost cylindrical, probably slightly flattened on the ventral surface. Mouth bent toward the ventral surface; anus almost terminal. Ventral surface with three series of pedicels, the middle one forming a thin double row, the two lateral a simple zigzag row. Each of the two dorsal ambulacra with a narrow double row of small conical papillæ. The two dorsal interambulacra carry a number of low whitish warts; the ventral surface also contains such warts though more sparingly. A crown of small papillæ surrounds the mouth. Tentacles about seventeen (?). Body-wall thin and pliable, supported by tables of a characteristic form; the disks are cross- or star-like, with from four to eight arms radiating from a common centre, and with the ends of the arms enlarged, flattened, and pierced with holes; sometimes the enlarged ends of some or all of the arms are connected with one another, thus constituting a perforated plate; the spire is composed of four rods, and one, seldom two, transverse beams; the spire is often devoid of transverse beams. The top of the spire is irregularly

spinous, often with four larger teeth. Colour in alcohol, whitish, inclining to violet or rose. Length of the largest specimen, 140 to 150 mm.

Habitat.—Station 306A, January 2, 1876; lat. 48° 27′ S., long. 74° 30′ W.; depth, 345 fathoms; bottom temperature, 46°·0; blue mud; four specimens. Station 308, January 5, 1876; lat. 50° 8′ 30″ S., long. 74° 41′ W.; depth, 175 fathoms; blue mud; two specimens. Station 311, January 11, 1876; lat. 52° 45′ 30″ S., long. 73° 46′ W.; depth, 245 fathoms; bottom temperature, 46°·0; blue mud; several specimens.

When the animal is fully extended, the body-wall does not seem to present any particular thickness along the sides of the body. The dorsal papillæ, which are placed in a narrow double row only on the dorsal ambulacra, are narrow, elongated, conical, and up to 5 mm. long. This arrangement in double rows is far more distinct in the specimens obtained at Station 311. The position of the pedicels is also more easy to distinguish in the specimens just mentioned. When the body is contracted, the three series of pedicels seem to be considerably broader. The slightly darker sucking-disks measure about 1 mm. in diameter. The warts, which are present on the two lateral dorsal interambulacra as well as on the ventral surface, do not form any rows; they are low, of a whitish colour, and mostly attain a greater diameter than the sucking-disks of the pedicels; at first sight one is tempted to consider them as disks of large retracted pedicels, but a closer examination shows the falsity of this supposition. The pedicels are strengthened by a large perforated terminal plate, surrounded by a few small, oblong, perforated, irregular plates and spinous, slightly curved rods. The pedicels also contain numerous tables in a more or less deformed state. The warts bear some tables near their base, but I cannot find any other deposits in them; they resemble large, flattened disks of pedicels without supporting rods and terminal plates. The papillæ bear at their top a very rudimentary terminal plate, consisting of an irregularly branched network, surrounded by a few transverse slightly spinous rods; crowded tables fill up the rest of the integument of the papillæ. The exact number of tentacles is not fully stated; in one individual I counted seventeen. The retractor muscles are, of course, absent, and the longitudinal muscular bands simple.

The shape of the deposits will be best understood from the figures (Pl. X. figs. 19, 20). The diameter of the disk is about 0·17 mm., and the length of the spire 0·064 mm. The spire, especially in the pedicels and papillæ, often terminates in four teeth, and the complete though irregularly perforated disks are also more frequent in these positions.

The animals seem to lack the calcareous ring. A single Polian vesicle, 16 mm. long, is present. The dorsal madreporic canal is attached to the dorsal mesentery. A bundle of slender, slightly branched genital tubes is situated on each side of the dorsal mesentery. Two respiratory trees run out from a common base, and neither of them has any more intimate connection with the pseudhæmal vessel system.

In one of the more complete specimens obtained at Station 311, I have observed some

small conical papillæ also on the sides of the body above the lateral ventral pedicels. The colour is also somewhat different, the specimens mentioned being light greyish inclining to brown.

The species here described is evidently nearly allied to *Stichopus natans*, Sars, and *Stichopus tizardi*, Théel.

Stichopus sordidus, n. sp. (Pl. VIII. fig. 3).

Tentacles twenty. The ventral pedicels not very obviously arranged in three series, the middle one broader than the lateral. A simple row of rather large conical processes present along each side of the body. Also larger and smaller processes or papillæ on the dorsal ambulacra, and some smaller ones spread over the interambulacra. Processes or papillæ not crowded, excepting round the mouth, where they form a crown. Deposits—tables alone, composed of a rounded or quadrangular, perforated disk with smooth margin and a spire of four rods and a single transverse beam. Spire of the tables terminating in about sixteen teeth. Dorsal papilla strengthened by numerous, curved, smooth, or slightly spinous rods; pedicels supported by a few rather large, irregularly bilateral, perforated plates. Colour in alcohol, dark brown, almost black, inclining to violet. Length in contracted state, 80 to 90 mm.

Habitat.—Station 167A, June 27, 1874; lat. 41° 4′ S., long. 174° 19′ E.; Queen Charlotte Sound, near Long Island (New Zealand); depth, 10 fathoms; mud; eight very contracted specimens.

All the specimens are very contracted and wrinkled, their true shape and size being unrecognisable. For the same reason, the position of the dorsal ambulacral appendages is not fully clear. Excepting the simple row of conical large prominences along each side of the body, which is always well defined, there seems generally to be an alternating row of equally large processes along each dorsal ambulacrum, and, besides, some smaller papillæ scattered not only on the ambulacra, but also on the interambulacra, where, however, they seem to be very rare. Consequently it appears that the processes and papillæ are principally collected on the two dorsal ambulacra as well as along the sides of the body. The larger processes have a length of about 8 mm. and a breadth at the base of 5 or 6 mm.

The calcareous ring is of the usual form, the radial pieces considerably larger, almost quadrangular and slightly incised posteriorly. A single madreporic canal and Polian vesicle are present. All the individuals have lost their viscera, excepting one which has a thin bundle of long, very narrow and slender genital tubes, several times branched, on each side of the dorsal mesentery.

Only one kind of deposit seems to be present, viz., tables (Pl. VIII. fig. 3, *a*, *b*, *c*); but it must be noted that I have also found a few oval buttons of the well known form with

six holes, though there seems to be but little doubt, that these belong to another animal and have adhered to the skin of the individuals examined by me. The diameter of the disks is about 0·05 mm., and the spire attains a height of about 0·04 mm. The fenestrated, irregularly bilateral plates (Pl. VIII. fig. 3, *d*) of the pedicels are rather large. So far as I can find out, this form brought home by the Challenger Expedition cannot be referred to any previously known species, though it doubtless bears some resemblance in external organisation to *Stichopus armatus*, Selenka, and *Stichopus japonica*, Selenka.

Stichopus godeffroyi, var. *b*, Semper, 1868 (Pl. VII. fig. 8).

Habitat.—Sandwich Islands; a single individual.

The only specimen at my disposal being very wrinkled, deformed, and covered with sea-weed, I cannot determine how the dorsal ambulacral appendages are arranged. A simple row of conical protuberances is easily enough distinguished along each side of the body, but I am by no means sure of the arrangement of the remaining dorsal appendages. However, I think I have observed some protuberances on the dorsal ambulacra, and, also, some small scattered papillæ on the interambulacra. The colour is yellowish-grey inclining to brown, lighter on the ventral surface. Two Polian vesicles and a single dorsal madreporic canal are present. The calcareous ring is like that in *Stichopus horrens*, Selenka; the radial pieces have four tops anteriorly, and the interradial a single one. Deposits—large tables (Pl. VII. fig. 8, *f*, *g*) with the spire terminating in a single conical top; large and small tables with the spire terminating in several teeth (Pl. VII. fig. 8, *a*, *b*, *c*); C-shaped bodies (Pl. VII. fig. 8, *e*); and dichotomously branched bodies (Pl. VII. fig. 8, *d*). The large tables seem to be present only in the dorsal perisome, have a height of 0·12 mm. to 0·14 mm., and their large irregularly rounded disks are pierced by numerous holes and have a diameter of about 0·12 mm. The small tables are present all over the body, and measure about 0·04 mm. in height; their spire terminates in about twelve teeth, and their disks are either rounded or angular. Besides these tables, one finds in the dorsal body-wall other tables of the same appearance but of much greater dimensions, their height being about 0·08 mm. and the diameter of their disks measuring as much as 0·072 mm. The C-shaped bodies have a length of about 0·14 mm., but those on the ventral surface seem to be smaller. The dichotomously branched bodies or rosettes are small, about 0·036 mm. in length. The pedicels as well as the dorsal ambulacral appendages are strengthened by strong, slightly curved rods, of which those in the former are usually dilated at the middle and perforated, while the dorsal rods, more curved, only have some finely spinous branches at the middle, which are sometimes united so as to form a single or a few holes.

The species is doubtless very nearly allied to *Stichopus horrens*, and if it can be shown that the Challenger specimen has the dorsal appendages in rows on the ambulacra only, it may be referred to that species.

Genus *Pseudostichopus*, n. gen.

Tentacles nineteen or twenty. Ambulacral appendages in the shape of pedicels alone (?); those on the ventral surface not arranged in the three longitudinal series characteristic of *Stichopus*. Two bundles of genital tubes present. Anus without teeth, but hidden in a distinct vertical furrow. Deposits unknown. Rectractors absent.

Pseudostichopus mollis, n. sp. (Pl. X. figs. 5, 6).

Body more or less elongately oval, equally rounded anteriorly and posteriorly. Mouth almost completely ventral in position. Tentacles twenty. Anus ventral, hidden in a rather deep furrow formed by two vertical folds of the perisome. Pedicels very minute, present only on the paired ambulacra; the odd ventral ambulacrum seems to be naked, if pedicels really exist, they must be very rudimentary. Pedicels of the dorsal surface arranged in a narrow double row along each ambulacrum, those of the lateral ventral ambulacra being more crowded and, as it seems, placed in two to five (?) rows. Calcareous deposits of the perisome absent. Colour in alcohol, light yellowish-white. Length, 140 mm.

Habitat.—Station 309A, January 8, 1876; lat. 50° 56′ S., long. 74° 14′ W.; depth, 140 fathoms; blue mud; six specimens. Station 311, January 11, 1876; lat. 52° 45° 30′ S., long. 73° 46′ W.; depth, 245 fathoms; bottom temperature, 46°·0; blue mud; numerous specimens. Station 144A, off Marion Island, December 26, 1873; lat. 46° 48′ S., long. 37° 49′ 30″ E.; depth, 50 to 75 fathoms; bottom, volcanic sand; two specimens.

Though I cannot find any deposits in the perisome, it seems very likely that such were present in the living animals, and, consequently, that they have been dissolved in the Challenger specimens by the influence of some acid. From the want of deposits as well as from the minuteness of the pedicels in general, a very careful examination is necessary to be convinced of the presence of these pedicels, which are almost indistinguishable from the exterior of the body. At first sight therefore one is tempted to consider the animals as belonging to the apodous Holothurids. For the same reasons I cannot positively state the absence of pedicels in the odd ambulacrum; sometimes I thought I observed some rudimentary ones. It is also almost impossible to tell the true shape of the ambulacral appendages, but, to judge from some small ones which I saw extended, they are probably pedicels and not papillæ. The vertical furrow in the posterior extremity of the body appears to be characteristic of the forms of this genus (Pl. X. fig. 5). The tentacles are retracted within the body and their processes retracted, but, as far as I can see, they must be allied to those present in the Aspidochirotæ.

The body-wall is soft, thin, and pliable; along the sides of the animals it is inconspicu-

ously thicker. The calcareous ring (Pl. X. fig. 6) is well developed, but in want of posterior prolongations. A single ventral Polian vesicle is present. The madreporic canal must be very inconsiderable, because I did not detect it in the three specimens examined by me. A bundle of rather long, slender unbranched genital tubes is situated on each side of the dorsal mesentery, and the long wide efferent duct opens on a small papilla, placed anteriorly on the dorsal surface. The longitudinal muscular bands are simple and not divided into two bands. Two well-developed respiratory-trees are present, running out from a common base, and neither of them seem to be in communication with the plexus of pseudhæmal vessels, though the left tree is embraced and held in a proper position by some larger "connecting branches" of vessels.

Since the above description was written I have received the two individuals dredged at Marion Islands. They agree closely with the specimens obtained from the other Stations, and the only difference of importance seems to be with regard to the tentacles, which in one of the examples from Marion Island are nineteen in number, but this must evidently be considered as a variation. In these two specimens, also, no pedicels are distinguishable in the odd ventral ambulacrum. With regard to the ventral lateral ambulacral appendages I am very dubious whether they be papillæ or pedicels. In one of the specimens they obviously resemble papillæ. The dorsal ambulacral appendages, on the contrary, bear a greater similarity to pedicels. The arrangement of the ventral lateral appendages, whether placed in two rows or more, is not clear. The deposits are totally dissolved, excepting in the dorsal pedicels, in which I have seen some fragments of spicules. The surface of the skin is covered with small Ascidians, Sponges, Bryozoa, &c., which have grown on it.

Pseudostichopus villosus, n. sp.

Body oval or elongated, equally rounded anteriorly and posteriorly. Mouth turned toward the ventral surface. Anus terminal, ventral, hidden in a rather deep furrow formed by two vertical folds of the body-wall. Tentacles nineteen or twenty, with numerous, crowded minute papillæ on the dilated terminal parts. Pedicels numerous, cylindrical and minute, often almost imperceptible, especially crowded along the sides of the body. Perisome soft and pliable, without calcareous deposits. Colour, lighter or darker brownish. Length up to 150 mm.

Habitat.—Station 146, December 29, 1873; lat. 46° 46′ S., long. 45° 31′ E.; depth, 1375 fathoms; bottom temperature, 35°·6 C.; Globigerina ooze; one incomplete specimen. Station 147, December 30, 1873; lat. 46° 16′ S., long. 48° 27′ E.; depth, 1600 fathoms; bottom temperature, 34°·2; Diatom ooze; one specimen. Station 156, February 26, 1874; lat. 62° 26′ S., long. 95° 44′ E.; depth, 1975 fathoms; Diatom ooze; one individual. Station 157, March 3, 1874; lat. 53° 55′ S.;

long. 108° 35′ E.; depth, 1950 fathoms; bottom temperature, 32°·1; Diatom ooze; one individual. Station 302, December 28, 1875; lat. 42° 43′ S., long. 82° 11′ W.; depth, 1450 fathoms; bottom temperature, 35°·6; Globigerina ooze; fragments of an individual. Station 325, March 2, 1876; lat. 36° 44′ S., long. 46° 16′ W.; depth, 2650 fathoms; bottom temperature, 32°·7; blue mud. Station 244, June 28, 1875; lat. 35° 22′ N., long. 169° 53′ E.; depth, 2900 fathoms; bottom temperature, 35°·3; red clay; one specimen. Station 216A, February 16, 1875; lat. 2° 56′ N., long. 134° 11′ E.; depth, 2000 fathoms; bottom temperature, 35°·4; Globigerina ooze; one individual. Station 296, November 9, 1875; lat. 38° 6′ S., long. 88° 2′ W.; depth, 1825 fathoms; bottom temperature, 35°·3; Globigerina ooze; one individual. Station 61, June 17, 1873; lat. 34° 54′ N., long. 56° 38′ W.; depth, 2850 fathoms; bottom temperature, 36°·2; red mud; two specimens.

The only difference between this species and the preceding one is, so far as I know, that it has much more numerous and crowded pedicels, and that these seem to be smaller. For the rest, it closely resembles the preceding species in internal and external organisation.

In the specimen dredged at Station 244 the pedicels are very numerous and fully extended, in consequence of which the ventral surface, and especially the sides of the body, present a villous aspect. The ventral surface and the sides are dirty brown, while the rest of the body is grey. The pedicels are brownish. The posterior vertical furrow, in which the anus is situated, is not very distinct in the species in question. As is the case in the other representatives of this species, the two branches of the respiratory-tree run out from a common base.

The individual obtained at Station 216 is remarkable in that the pedicels of the dorsal surface and the sides of the body are slightly thicker and larger than those of the ventral surface, which are thread-like and very minute. Here, also, no deposits are visible. The Challenger Expedition also brought home from Station 61 two specimens, which must probably be referred to this species, though they differ from the preceding forms in having in the ventral perisome a part of the deposits left, though in a state of dissolution. These deposits are very peculiar, resembling rounded, flattened mulberries composed of numerous small irregular corpuscles. Several such deposits are aggregated here and there within the perisome. These deposits are probably much deformed by the influence of some acid. In the specimen from Station 244 I have seen some remains of deposits which must have had the shape of perforated plates. In the dorsal perisome, on the contrary, I cannot find any deposits at all. The brownish pedicels do not seem to be so numerous as in several of the preceding forms.

Pseudostichopus villosus, var. *violaceus*, nov. (Pl. X. fig. 6*b*).

Habitat. Station 156, February 26, 1874; lat. 62° 26′ S., long. 95° 44′ E.; depth, 1975 fathoms; Diatom ooze; one specimen.

This variety is distinguished by its dark violet colour. No other characters distinguishing it from the main forms have been observed. The tentacles are twenty in number. The vertical furrow, in which the downwardly directed anus is situated, is very distinct. The minute pedicels are numerous and distributed all over the body, and therefore also over the ventral surface, the foremost part of which, however, seems to be almost naked. Nor processes nor papillæ are visible. Length of the specimen about 170 mm. The body is oblong and more tapering posteriorly. Mouth ventral in position. The intestinal canal is of a dark violet colour. The calcareous ring (Pl. X. fig. 6*b*) has a somewhat different form, which, however, probably depends upon the degree of contraction. The slightly branched genital tubes have a considerable width, and are, like those in the main forms, collected into two thick bundles, one at each side of the dorsal mesentery. The two respiratory-trees run out from a common base.

Genus *Holothuria*, Linné, 1758.

Holothuria monacaria, Lesson, 1830 (Pl. VIII. fig. 10).

Habitat.—Fiji Islands; two specimens. Ternate (Molucca Islands); one individual.

Owing to the animals being highly contracted and wrinkled, their true size and shape are very difficult to distinguish. However, the body seems to be more or less markedly cylindrical, tapering equally towards each extremity. The length of the largest specimen is about 100 mm. The tentacles are twenty in number, and retracted within the body. The mouth is surrounded by a crown of small papillæ. The anus also carries some small, more irregularly disposed papillæ. The ventral pedicels seem to be more numerous than the dorsal papillæ. Both kinds of ambulacral appendages seem to reach about the same size, though the papillæ are broader at the base. When fully extended they attain a length of about 4 mm. or slightly more. In consequence of the papillæ being mostly completely retracted, it is not easy to distinguish their conical form from the cylindrical one which characterises the pedicels. But a few papillæ, being extended, evidently show that they are true papillæ. The sucking-disks of the papillæ are minute in comparison with those of the pedicels, and there also exists, of course, a great difference in size between the respective terminal plates. Owing to the contracted and wrinkled state, the arrangement of the pedicels in three longitudinal series is not very clear. Probably for the same reason, the dorsal papillæ do not present any distinct arrangement in longitudinal rows.

Colour in alcohol—ventral surface light yellowish-grey; dorsal surface darkish brown, inclining to greenish, excepting the papillæ and a space round their base which are yellowish-white. When the animal is wrinkled and contracted the dorsal surface gives the impression of being transversely streaked with brown and yellowish-white.

The calcareous ring is of the usual shape without posterior prolongations. Two ventral Polian vesicles are present, one of which measures about 100 mm. in length. A single dorsal madreporic canal is present. The genital organs are destroyed.

The deposits bear the closest resemblance to those in *Holothuria pardalis*, Selenka, &c., but the tables are devoid of spines on the disks, and the buttons are more uniformly crowded beneath the former all over the body. The numerous tables (Pl. VIII. fig. 10, *a*, *b*, *c*) have the disk small and smooth, and the spire composed of four rods united by a single transverse beam. The spire terminates in about eight or more teeth. The tables are about 0·048 mm. high, and their disks measure up to 0·056 mm. in diameter. The buttons (Pl. VIII. fig. 10, *d*), which are usually pierced by six holes, vary slightly in size, but the larger ones have a length of 0·068 mm. In the pedicels and papillæ the buttons often grow slightly larger, and are sometimes pierced by more than six holes. The pedicels bear near their ends irregularly rounded, perforated plates or even more elongated rod-like ones, which are of a more or less marked bilateral shape (Pl. VIII. fig. 10, *e*). Besides larger spinous or perforated, irregular rods resembling those in the pedicels, the papillæ carry small, more or less curved, simple or branched, spinous rods (Pl. VIII. fig. 10, *f*, *g*); the small supporting rods of the papillæ measure only 0·05 mm. in length, while the larger ones are 0·2 mm. long.

Holothuria minax, n. sp. (Pl. VIII. fig. 8).

Body elongated, slightly flattened on the ventral surface and furrowed along its middle. Tentacles eighteen. Anus roundish. Ventral surface with pedicels. Dorsal surface with small conical papillæ, a number of those situated along the sides of the body and in the neighbourhood of the dorsal ambulacra being placed on low warts with a broad base. The papillæ at the mouth and anus are slightly larger. Deposits of two kinds—tables with the rounded disk perforated by a central large opening and a series of smaller peripheral holes, and bearing a short spire composed of four rods and one transverse beam, and terminating in about twenty teeth or spines; and oval, regular or asymmetrical smooth buttons with six to ten (or more) holes. Pedicels strengthened by more or less symmetrically bilateral, perforated rods. Papillæ with perforated rods commonly of a more irregular shape. Colour in alcohol, light yellowish-brown; the ventral surface and the warts lighter. Length in contracted state about 160 mm., but probably much greater when the body is fully extended.

Habitat.—Japan; depth, 8 to 14 fathoms; one specimen.

Like many other Holothurians kept in alcohol, the body is very much contracted and wrinkled, its true size and shape being almost impossible to discern. For this reason I cannot state whether the pedicels are arranged in three longitudinal series or distributed without order. Even the position of the dorsal warts and papillæ is not fully known, though I have observed that the warts which carry papillæ are situated mainly on or in the neighbourhood of the dorsal ambulacra as well as on the sides of the body. Numerous papillæ are situated between the warts on the ambulacra as well as inter-ambulacra. The warts are always very low though with a broad base. The calcareous ring is of the usual form, almost like that in *Holothuria decorata*, von Marenzeller. A single Polian vesicle, 27 mm. long, is present. On the left side of the dorsal mesentery is a single madreporic canal, on the right side three, all with the free ends enlarged and pear-shaped.

The tables (Pl. VIII. fig. 8, *a*, *b*) as well as the buttons (Pl. VIII. fig. 8, *c*) closely resemble those in the above-named species described by von Marenzeller, but I never found more than one transverse beam in the spire of the tables, while *Holothuria decorata* has tables partly with a shorter spire and one transverse beam and partly with a larger spire and as many as three beams. The disks of the tables, which measure about 0·08 mm. in diameter, usually possess a simple series of holes surrounding the central large hole, and I only once observed a disk with more holes round the margin. The buttons sometimes present themselves under a more unusual shape as will be seen from the figures; the larger ones have a length of 0·1 mm. The pedicels carry, besides the perforated rods (Pl. VIII. fig. 8, *d*), more or less completely developed tables and buttons.

There is no doubt that the animal in question is related to *Holothuria decorata* as well as to *Holothuria monacaria*, Lesson, and, though I cannot be sure of the position of the pedicels and processes, it probably belongs to *Stichopodes* of Semper.

Holothuria africana, n. sp. (Pl. VIII. fig. 7).

Body cylindrical, equally rounded at each extremity or slightly more tapering posteriorly. Mouth closed and ventral in position. Tentacles twenty (?), completely withdrawn into the body. Anus rounded. Ambulacral appendages minute, scattered without order all over the body, the dorsal ones slightly smaller than the ventral, and presenting themselves, as it seems, under two different forms, some being more conical, papilla-like and without any very marked sucking-disk, others, on the contrary, having a cylindrical form with a more distinct sucking-disk and approaching true pedicels in general appearance. All the ventral ambulacral appendages are true pedicels with well-defined sucking-disks, and seem to be slightly more crowded. Body-wall very thick and inflexible, probably the result of strong contraction in alcohol. Deposits of two kinds—tables and

plates. The tables have the perforated disk smooth, undulating, or provided with spines in the margin, and their spire, composed of four rods and one transverse beam, terminates in twelve teeth. The plates, much more numerous than the tables, and crowded in heaps, are commonly rounded, flat and disk-like, with the margin slightly uneven, and perforated by more or less numerous minute holes; among these other more or less irregularly rectangular plates with fewer but larger holes are to be found. The dorsal conical appendages are alone furnished with transverse supporting rods near the more or less incompletely developed terminal plates; the rest of the dorsal appendages as well as the ventral pedicels seem to be devoid of any rods or plates, or only have a few irregular plates round the terminal plate which is always well developed. Colour in alcohol, dark greyish-brown on the back and the sides, and light almost whitish-grey on the ventral surface; the ventral pedicels brownish. Length about 190 mm.

Habitat.—Simon's Bay; depth, 10 to 20 fathoms; a single specimen.

This species is remarkable in possessing, besides true minute dorsal pedicels, minute dorsal papillæ which differ from the former not only in their exterior form, but especially in the presence of simple or slightly branched, strong rods. It seems as if the dorsal papillæ are less numerous than the dorsal pedicels.

The calcareous ring seems to be of the usual shape without posterior prolongations. The Polian vesicles are numerous, up to twelve or more, of unequal size, and some of them carry small branches at their base. A bundle of from five to sixteen madreporic canals with pear-shaped ends is situated on each side of the dorsal mesentery. The reproductive organs consist of a bundle of tubes, several times branched, situated on the left side of the dorsal mesentery. The respiratory-trees are well developed

The tables (Pl. VIII. fig. 7, *a*, *b*, *c*), when fully developed, have a simple circle of holes round the margin of the disk which attains a diameter of about 0·056 mm.; their spire is about 0·04 mm. high. Most of the disks are smooth, but I have often seen them with spines. In the pedicels, the disks of the tables are absent or reduced to a simple ring. The rounded flat plates, about 0·03 mm. in diameter (Pl. VIII. fig. 7, *e*), are characterised by their minute holes, and they seem to be collected into heaps in some parts of the body. The other plates (Pl. VIII. fig. 7, *d*), which attain about the same size as the former, have a more irregular form, but they often present themselves under the shape of a more or less irregular rectangle; they have some resemblance to disks of the tables, and their surfaces are not always quite even. The species in question is possibly identical with Ludwig's *Holothuria mexicana*.

Holothuria spinifera, n. sp. (Pl. VIII. fig. 1).

Body cylindrical, equally rounded anteriorly and posteriorly. The closed mouth surrounded by a collar of small papillæ. Tentacles twenty (?). Anus with five groups

of small, very spinous cylindrical papillæ, thus stellate in appearance. Ambulacral appendages—papillæ, rather closely placed all over the body, without any arrangement in rows. Deposits—tables with rounded, somewhat irregularly perforated disk and a short spire, built up of four rods and one transverse beam, and terminating in a rounded very spinous top; knobbed buttons, mostly with six holes and very often with irregular beams joining the tops of several knobs. Besides numerous perforated transverse rods, the papillæ possess tables near their ends which have the disk perforated by numerous holes and the spire drawn out into a very long simple point, communicating to the papillæ a very rough and spinous aspect. Colour in alcohol—ventral surface whitish inclining to yellowish, with some large light brownish spots at the middle; dorsal surface light brown inclining to yellowish on the sides, and with some larger darker spots at the middle. Length about 240 mm.

Habitat.—Station 208, January 17, 1875; lat. 11° 37′ N., long. 123° 31′ E.; depth, 18 fathoms; blue mud; one specimen.

This species is doubtless nearly allied to Semper's *Holothuria aculeata*, but Semper does not mention anything about the characteristic tables in the papillæ, and therefore I must suppose that *Holothuria aculeata* is devoid of them. Some other differences exist which will be stated further on.

To judge from the single contracted specimen I have at my disposal, the conical papillæ along the sides of the body are slightly larger than the rest, and the sides themselves slightly thickened. Besides, the dorsal papillæ seem generally to be more conical than those of the ventral surface, which are like rounded warts. Especially the dorsal papillæ and the papillæ round the anus are obviously spinous to the naked eye, owing to the long spire of the tables. Owing to the groups of papillæ, the anus acquires a stellate aspect.

The calcareous ring is of the usual shape without posterior prolongations. The Polian vesicle has a length of 35 mm. The madreporic canal is uncommonly large and thick, attaining a length of about 40 mm. or more; it contains a network of very fine calcareous threads. A thick bundle of long, genital tubes, branched three to four times, is situated on the left side of the dorsal mesentery. The respiratory-trees are very well developed and branched.

The calcareous tables (Pl. VIII. fig. 1, *a*, *b*) attain a height of about 0·1 mm., and their disks are commonly convex on the inner surface; the buttons (Pl. VIII. fig. 1, *e*, *f*), are about 0·05 mm. long, and their central knobs are generally larger than the peripheral ones. The buttons often have a very asymmetrical appearance owing to the beams which join the tops of the knobs. The characteristic tables of the papillæ (Pl. VIII. fig. 1, *c*, *d*) have a large, irregular disk with numerous holes, and measuring as much as 0·14 mm. in diameter; and their spire, attaining a length of 0·36 mm., is built up of four rods which become united so as to form a single long, straight spine.

Holothuria martensii, Semper, 1868 (Pl. VII. fig. 12; Pl. XVI. fig. 2).

Habitat.—Station 188, September 10, 1874; lat. 9° 59′ S., long. 139° 42′ E.; depth, 28 fathoms; green mud; a single specimen. Station 203, October 31, 1874; lat. 11° 6′ N., long. 123° 9′ E.; depth, 20 fathoms; mud; one individual.

In the contracted state the body has a length of 150 mm., and is provided with conical papillæ, which become largest towards the sides of the body, where they form a longitudinal series along the line of junction of the dorsal and ventral surfaces. The largest papillæ have a length of about 7 mm. and a breadth at the base of about 4 mm. The papillæ, which are not very closely placed, decrease towards the middle of the dorsal and ventral surfaces; those on the dorsal surface being slightly more numerous and more distinctly pointed than the ventral ones, which seem to be more rounded. The closed mouth, which is ventral in position, is surrounded by a circle of smaller papillæ. The anus is terminal, roundish, and has a few very small papillæ on the margin. The tentacles are twenty (?), fully retracted and small. The colour is whitish or pale greyish on the sides, and darker on the dorsal and ventral surfaces from numerous, crowded, minute, brownish specks. The inside of the perisome is characterised by numerous small dark dots.

The calcareous ring (Pl. VII. fig. 12, *c*) is of the usual shape without posterior prolongations. The madreporic canal, 10 mm. long, terminates in a pear-shaped end. A single Polian vesicle, about 50 mm. long, is present. The genital tubes are twice or three times dichotomously branched. A thick bundle of short Cuvierian organs is present.

The calcareous deposits closely resemble those in *Holothuria ocellata*, to which this species is nearly related, excepting that the tables are provided with an elongated conical spire composed of four rods and as many as six or seven transverse beams. The top of the spire generally carries several small spines, but I have also found tables which are almost devoid of spines. Sometimes the four rods which constitute the spire of the tables carry spines, but I never found such large ones as those figured by Semper. The disk of the tables is rather large and pierced by more holes than in *Holothuria ocellata*. The tables (Pl. VII. fig. 12, *a*, *b*) measure from 0·1 mm. to 0·16 mm. in height. The papillæ have almost a spinous appearance from the long spires of the table. The numerous buttons and supporting rods of the papillæ are exactly like those in the above-named species. In this specimen also many elongated buttons with numerous holes in two rows are to be found, but those with six holes are the most common. The elongated buttons with numerous holes are rarer, and it is to be observed that the knobs on these are less prominent, sometimes nearly inconspicuous. Though the specimen does not fully agree with the description given by Semper, the similarity is very obvious. The specimen examined by Semper is much smaller.

The papillæ are supported by numerous solid rods which are either perforated at

the middle and at each end, or have a more or less complete series of holes along each side.

The above description concerns the specimen from Station 188. That obtained at the Philippine Islands is considerably smaller, only 85 mm. long, and its colour is darker from a greater abundance of slightly larger brownish specks. The odd ambulacrum is marked out by a narrow dark line. The specimen agrees in all points with the above description, excepting in the size of the papillæ, which here are comparatively slightly larger, and, above all, in the shape of the buttons. In the specimen from Station 188 the knobbed buttons with six holes are by far the most common. In this individual, on the contrary, it is rarer to find these smaller buttons, while the more elongated kind with numerous holes are abundant. Thus, I have found here a whole series of transitional forms of buttons from those with six holes to a very elongated, narrow form, 0·14 mm. long, with as many as sixteen holes, eight in each row. In the longest buttons the knobs almost disappear. Considering the great resemblance in all other points, and that such long buttons with numerous holes are not rare even in the specimen from Station 188, I think the two forms must be referred to the same species, though possibly the smaller form may be considered as a variety.

Holothuria ocellata, Jæger, 1833 (Pl. VII. fig. 11; Pl. XVI. fig. 1).

Habitat.—Station 188, September 10, 1874; lat. 9° 59′ S., long. 139° 42′ E.; depth, 28 fathoms; green mud; one specimen.

There seems to be but little doubt that these animals, brought home from the neighbourhood of Torres Strait, are identical with Jæger's form found at Celebes.

The animal, which in the contracted state has a length of about 170 mm. and a breadth of 55 mm., is of cylindrical form, rounded anteriorly and slightly more tapering posteriorly. The dorsal surface is strongly convex, the ventral almost flat or inconsiderably convex. The body is angular along each side on the line of junction of the two surfaces, which thus become more distinct from one another. The mouth with the retracted tentacles has a ventral position, and the round anus is terminal. The anus is surrounded by very small, elongated, conical papillæ. The whole surface of the body is covered by larger and smaller conical papillæ or prominences, which do not seem to be retractile; the largest papillæ, about 7 mm. long and 4 mm. broad at the base, are situated along the angles of the sides of the body, forming a kind of brim along the sides; those on the ventral surface are slightly smaller than the dorsal. Tentacles twenty (?), of unequal size. Round the closed mouth is a series of papillæ. Colour in alcohol, whitish, with minute brownish specks or dots, which are more crowded along the middle of the ventral surface, which is thus darker; on the dorsal surface the specks are more confluent so as to

cause a reticulate appearance. A dark brownish circular ring surrounds the bases of the papillæ, and this ring is in its turn encircled by a second whitish ring, which is especially distinct on the back. The upper part of the papillæ is whitish. The papillæ along the angles of the body, however, are not enclosed by these rings, which are confluent and form an irregular, undulated dark line along each side above the row of papillæ and another line, though more indistinct, on the ventral surface.

The calcareous ring (Pl. VII. fig. 11, *f*) is of the usual shape without posterior processes. A single large madreporic canal with the free end enlarged and pear-shaped, and several (seven) Polian vesicles are present. The reproductive organs are made up of a single bundle of long, cylindrical, narrow tubes, which are bipartite or tripartite only at the base.

The integument is not very thick, and contains tables and knobbed buttons. The tables (Pl. VII. fig. 11, *a*, *b*, *c*) are robust, and their perforated disk is mostly smooth on the margin and convex on the inner surface; I have sometimes seen spines on the margin. The spire is usually short, about 0·048 mm. long, broad and built up of four rods, united by a single transverse beam under the top, which is mostly rounded and covered with spines. Among these tables I have also seen others with the spire more slender and with two transverse beams and also a few with a larger, more irregularly reticulate disk and a slender, longer spire with about three transverse beams. The most common buttons (Pl. VII. fig. 11, *d*) are oval, with six holes and two knobs on the middle beam and some less prominent ones on the margin. Their length is about 0·04 mm. But I have also found much more elongated buttons with numerous holes in two rows and many knobs, so that the margin becomes very uneven. A series of transitional forms is to be found between the extremes. The papillæ are strengthened by strong, curved rods (Pl. VII. fig. 11, *e*), with perforated ends, and dilated and provided with holes, at the middle only, or along one or both sides. Semper's *Holothuria squamifera* is doubtless nearly allied to this species of Jæger, which, however, is devoid of smooth buttons, &c.

Holothuria impatiens, Forskaal, 1775 (Pl. VII. fig. 9).

Habitat.—Fiji Islands; a single specimen. Sandwich Islands; one specimen.

The incomplete specimen brought home by the Challenger Expedition from the Fiji Islands has a length of about 95 mm. The calcareous ring, tentacles, &c., are destroyed. The colour in alcohol is pale greyish or reddish-brown, excepting along the dorsum, where it is auburn. The rounded warts which carry the pedicels are pale, inclining to yellowish, excepting along the back, where they are darkish brown. The surface of the perisome is rough from the spinous tops of the tables. The tables (Pl. VII. fig. 9, *a*, *b*, *c*) have a height of about 0·068 mm., and their disks measure 0·11 mm. in diameter. The

disks have quite a smooth margin, and the number of holes seems, as a rule, to be nine. The buttons (Pl. VII. fig. 9, *d*) are smooth and mostly regularly formed with six holes in two rows; their length is about 0·08 mm. The rods in the pedicels (Pl. VII. fig. 9, *e*) have commonly the form given on the plate. A bundle of very large, unbranched Cuvierian organs, about 50 mm. long, is present.

The specimen obtained at the Sandwich Islands mainly differs in its uniform brown colour and in the smallness of its slightly darker coloured warts.

Holothuria vagabunda, Selenka, 1867 (Pl. VII. fig. 10).

Habitat.—Tongatabu (Friendly Islands); one individual. Samboangan (Philippine Islands); one individual. Fiji Islands; a single specimen.

I am in great uncertainty with regard to the ambulacral appendages of the dorsal surface, they may be considered either as pedicels or papillæ. Some of them have a more or less obviously conical form and resemble papillæ, others are more cylindrical; a closer examination proves that the former are devoid of a true sucking-disk, have the terminal plate very rudimentary and the walls strengthened by numerous spinous transverse rods, while the latter have a small though distinct sucking-disk, a much larger terminal plate and comparatively few supporting rods; these rods are only collected around the terminal plate, and are not distributed over a greater space as is the case in the papillæ, and, like those in the ventral pedicels, they generally resemble elongated plates with two more or less incomplete rows of holes, or bilaterally symmetrical, fenestrated, more or less elongated plates. Evidently, then, the dorsal ambulacral appendages are of two kinds, viz., pedicels and papillæ. The ventral appendages are slightly more numerous than the dorsal ones; in the specimen from Tongatabu they seem to be much more numerous and crowded; this, however, depends upon a higher degree of contraction of the ventral perisome.

The colour of the individual from the Philippine Islands is pale brown, while the specimen from Tongatabu is darkish brown. I cannot with certainty state the number of tentacles which are fully retracted within the body, but I believe there are eighteen in the specimen from Tongatabu. A single madreporic canal is present. The individual from Tongatabu is provided with three Polian vesicles, while the other has only one or two. Cuvierian organs of a reddish-brown colour are present. The deposits obviously resemble those in the typical *Holothuria vagabunda;* scattered among the common tables with the wide annular apex of the spire provided with eight to ten teeth, others are found with their spire much more tapering towards the apex, which becomes very narrow and comparatively inconsiderable. The disks of the tables (Pl. VII. fig. 10, *a*) are often uneven in the margin and even spinose, but there are also many disks to be found which have the margin rounded, smooth, and slightly undulating. The

buttons (Pl. VII. fig. 10, *d*) have generally six holes, but it is not very rare to find them with eight holes, especially in the papillæ.

The third specimen, obtained at the Fiji Islands, is like that from the Philippine Islands in colour and general appearance.

Holothuria atra, Jæger, 1833 (Pl. VII. fig. 4).

Habitat.—Amboina; a single individual. Fiji Islands; a single specimen. Station 177, August 18, 1874; lat. 16° 45′ S., long. 168° 7′ E.; depth, 130 fathoms; bottom, volcanic sand; a single specimen.

Each of the specimens obtained at the above mentioned Stations has a length of about 180 mm.; when fully extended they must be much longer. The dorsal papillæ are much more scattered than the ventral pedicels, and do not exceed them in size. Some of the tentacles seem to be absent in the specimen from Amboina. The deposits have been already correctly described by Selenka. The small disks of the tables (Pl. VII. fig. 4, *a*) are either smooth on the margin or provided with spines. Close to the well-developed terminal plate of the pedicels, fenestrated, often symmetrically bilateral plates are to be found. The papillæ, on the contrary, contain slightly curved, smooth, or spinous rods, mostly with the enlarged ends fenestrated or branched. The colour is darkish brown, almost black. The Polian vesicles often seem to be more than three in number. The terminal plates of the dorsal papillæ are very rudimentary.

Holothuria curiosa, Ludwig (Pl. VIII. fig. 9).

Habitat.—Samboangan (Philippine Islands).

The only specimen brought home by the Challenger Expedition almost completely agrees with that described by Ludwig. Its length is about 100 mm., and its colour is greenish-brown, darker on the dorsal surface, and almost black round the anal aperture. A fine distinct darkish brown ring surrounds the bases of the pedicels and papillæ. The pedicels are slightly more crowded than the papillæ. The very small, irregularly but closely placed dorsal papillæ seem to be situated on small warts. The slightly larger ventral pedicels are also scattered without order. The anus is round, and the mouth surrounded by a slight brim.

The calcareous ring is of the usual shape without posterior prolongations. Unlike the animals examined by Ludwig, the Challenger specimen is furnished with only a single vesicle, 25 mm. long.

The single, free, dorsal madreporic canal has a length of 6 to 7 mm. The reproductive organs are very small, and their fine, narrow tubes are once or twice

dichotomously branched. A bundle of a few rather large, simple Cuvierian organs is present.

The deposits are not very well developed. The buttons (Pl. VIII. fig. 9, *b*) are very irregularly formed, with from two to six holes; their length is as much as 0·03 mm. Near the ambulacral appendages the buttons often become larger and the number of holes greater (Pl. VIII. fig. 9, *c*). The tables (Pl. VIII. fig. 9, *a*) have the disk small, often rudimentary and confined to a simple ring; in the larger tables the disk measures 0·03 mm. in diameter. The spire of the tables is more or less rudimentary; compare the figures. The pedicels are strengthened by perforated rods or rod-like plates (Pl. VIII. fig. 9, *d*), with the holes often arranged in two longitudinal series. In the papillæ, which have a very poorly-developed terminal plate, the deposits seem to be a little more rod-like than in the pedicels.

Holothuria fusco-rubra, n. sp. (Pl. VII. fig. 2).

Habitat.—Sandwich Islands; a single specimen.

This specimen seems to be nearly allied to the preceding species, with which it agrees in nearly all respects. I may therefore refer to the description of Ludwig, while I here only point out the differences. When fully extended it attains a considerable size; its colour is uniformly dark brown inclining to reddish, and the brown rings of the pedicels and papillæ are totally absent. The pedicels are much more numerous than the dorsal papillæ, which are comparatively few, so that an obvious line of demarcation is visible between the dorsal and ventral surfaces. There are also some slight differences in the deposits. Thus the disks of the tables (Pl. VII. fig. 2, *a*), about 0·06 mm. in diameter, have the margin very uneven and often provided with spines. The spire of the tables is totally absent or reduced to a few short spines (commonly four), the apices of which are very seldom joined by transverse beams. When such transverse beams were present, I never found any teeth, characteristic of the tables in other Holothurians. The most incompletely developed buttons (Pl. VII. fig. 2, *b*) have a length of about 0·06 mm.; in a complete state the buttons are pierced by six holes in two rows. In the ambulacral appendages longer buttons with more holes are to be found. The pedicels, which are more crowded than the papillæ, bear near their ends fenestrated irregular plates (Pl. VII. fig. 2, *c*), and the scattered small dorsal papillæ are strengthened by slightly curved and spinous rods. The Cuvierian tubes are very well developed.

So far as I can see, this form cannot be referred to any previously described species, though it bears the closest resemblance to several of them, especially to *Holothuria curiosa*, *Holothuria vagabunda*, and *Holothuria lagoena*.

Holothuria lactea, n. sp. (Pl. X. figs. 9 and 15).

Body elongated, oval. Mouth turned towards the ventral surface. Anus almost terminal. Tentacles small, twenty. A simple row of pedicels along each side of the ventral surface. The odd ambulacrum naked. Dorsal surface with small, very much scattered papilla-like prominences. Perisome soft and pliable, containing numerous crowded delicate tables consisting of a large rounded or stellate disk pierced by six very large holes arranged round a small central hole, and bearing a strongly constructed central spire built up of three rods and one transverse beam; the spire terminates in three very long smooth teeth. Colour, milk-white. Length about 110 mm.

Habitat.—Station 78, July 10, 1873; lat. 37° 26′ N., long. 25° 13′ W.; depth, 1000 fathoms; volcanic mud; two fragments. Station 169, July 10, 1874; lat. 37° 34′ S., long. 179° 22′ E.; depth, 700 fathoms; bottom temperature, 40°·0; blue mud; a single individual.

The ventral surface is evidently flatter than the dorsal, and does not bear any other ambulacral appendages than the simple row of pedicels along each side. These pedicels, only about twenty in each row, are not closely crowded but placed at some distance from each other, and measure about 8 mm. in length; their ends are slightly enlarged, the pedicels thus acquiring a clavate appearance. The terminal plates of these pedicels are not very well developed. The enlarged ends of the pedicels are strengthened by numerous crowded, almost smooth, more or less curved, transverse, unbranched rods. The pedicels also contain more or less deformed tables in great abundance. The very minute papilla-like dorsal ambulacral appendages are few and scattered; besides a rudimentary terminal plate and a great number of more or less deformed tables, they contain a few curved spicules. The twenty tentacles are small and seem to terminate in about four processes. The perisome is filled up by tables (Pl. X. fig. 9) which have a very characteristic shape. The disks of these tables have a very fine conformation, and their circumference is either rounded or stellate with six angles; they are pierced by six large peripheral holes and a small central hole; the diameter of the disks is about 0·2 mm. The spire (Pl. X. fig. 15, *b*) is more firmly constructed, and attains a length of about 0·24 mm.; it consists of three rods joined near the base by a transverse beam; from the apex, where the three rods are united, three long, slender, smooth, divergent teeth arise. In the pedicels and papillæ especially the disks of the tables are more or less deformed. A single short Polian vesicle is present. The small madreporic canal is attached by its tubercle to the dorsal body-wall in its middle line. The reproductive organs are situated on the left side of the dorsal mesentery, and consist of several genital tubes, each terminating in a bundle of short slightly branched sacs, within which the eggs are visible. The longitudinal muscular bands are simple and without retractors. Two wide and well developed respiratory-trees are present and do not seem to be in any

intimate connection with the vessels of the pseudhæmal system. The above diagnosis and description refers to the individual obtained at Station 169.

The fragmentary specimens obtained at Station 78 are doubtless identical with the preceding form; their deposits have exactly the same appearance.

Holothuria thomsoni, n. sp. (Pl. X. figs. 8, 11).

Body oval. Mouth turned downwards. Anus almost terminal. Tentacles twelve in number, in general shape like those in Aspidochirotæ. A simple slightly alternating row of pedicels along each side of the ventral surface, and some small papillæ scattered on the ventral surface in the neighbourhood of these rows. No other ambulacral appendages are visible on the exterior. Perisome unusually rough, from an abundance of crowded tables consisting of large, irregularly perforated disks with the central hole usually smaller than the peripheral ones; the spire is composed of three rods and one transverse beam, and terminates in three very long, slender, and spinous teeth. Colour in alcohol, greyish. Length about 125 mm.

Habitat.—Station 237, June 17, 1875; lat. 34° 37′ N., long. 140° 32′ E.; depth, 1875 fathoms; bottom temperature, 35°·3; blue mud; a single incomplete specimen. Station 244, June 28, 1875; lat. 35° 22′ N., long. 169° 53′ E.; depth, 2900 fathoms; bottom temperature, 35°·3; red clay; three specimens.

The body seems to be more flattened on the ventral than on the dorsal surface. Each of the two rows of pedicels contains forty to fifty. The length of these pedicels and their breadth at the base are about 5 mm. Excepting the small papillæ or pedicels in the neighbourhood of the rows above mentioned, no other ambulacral appendages are visible protruding beyond the surface of the skin; but, on examining the inner surface of the perisome, one finds a great number of small pores along the odd ambulacrum and a very few scattered on the back, which possibly may indicate the presence of minute pedicels. The tables (Pl. X. fig. 11, *a*, *b*) bear a certain resemblance to those in the preceding species, but the disks are more irregular and are provided with a greater number of holes; their spire is characterised by the spinous teeth. The disks measure about 0·26 mm. in diameter, and the spire is of about the same length. The pedicels possess, besides a rudimentary terminal plate, smaller, more regularly perforated tables (Pl. X. fig. 11, *d*, *e*) and slightly curved and spinous rods (Pl. X. fig. 11, *c*). The calcareous ring is narrow, fragile, and of the usual shape, without posterior prolongations. The longitudinal muscles are simple and devoid of retractors. A bundle of three small Polian vesicles is present.

The specimens brought home from Station 244 deviate in some degree from the above diagnosis, and in some respects they are more nearly allied to the preceding species. In fact, the deposits closely resemble those in *Holothuria lactea;* thus the

disks of the tables are very symmetrical, star-like, with six larger holes round the smaller central aperture (Pl. X. fig. 8). Only a simple row of from nine to fourteen elongated pedicels is present on each side of the ventral surface; besides these, no other pedicels or papillæ seem to exist. In one individual I observed thirteen small tentacles.

Holothuria thomsoni, var. *hyalina*, nov.

Habitat.—Station 158, March 7, 1874; lat. 50° 1′ S., long. 123° 4′ E.; depth, 1800 fathoms; bottom temperature, 33°·5; Globigerina ooze.

The single specimen obtained by the Challenger Expedition has a length of 68 mm. Its body-wall is glassy from numerous crowded tables, exactly like those in the type form excepting that the three teeth of their spire are less spinose. Tentacles fifteen. The pedicels are not very distinct, but, so far as I can judge from the incomplete specimen at my disposal, they are few and arranged in a simple row along each side of the ventral surface. Having been unable to detect any other peculiarities, I propose for the present to consider the specimen in question as a variety of *Holothuria thomsoni*.

Holothuria murrayi, n. sp. (Pl. X. figs. 16–18).

Body elongated, more or less distinctly cylindrical, with mouth and anus almost terminal. Tentacles twenty. Each lateral ventral ambulacrum with numerous pedicels, the larger of which seem to form a continuous row along each side of the body; the remaining pedicels are of unequal size, and sparsely distributed over the adjacent interambulacra. The odd ambulacrum with numerous, very minute, almost imperceptible pedicels. Dorsal surface with few, small, and scattered papilla-like pedicels. The dorsal as well as the ventral interambulacra have only a few minute ambulacral appendages in their middle line. Perisome thin, flexible, and rough from closely placed tables, consisting of a more or less irregular, perforated disk, typically with six large holes round a central hole, and a spire built up of three rods and one transverse beam. The spire terminates in three rather long teeth, the free ends of which are spinose or branched. Colour in alcohol, greyish inclining to violet, which is especially obvious along the middle of the ventral surface; some larger violet spots are visible on the dorsal surface, evidently indicating that this colour predominates during life. Length, 240 mm.

Habitat.—Station 300, December 17, 1875; lat. 33° 42′ S., long. 78° 18′ W.; depth, 1375 fathoms; bottom temperature, 35°·5; Globigerina ooze; two individuals.

The mouth is slightly bent towards the ventral surface. The cylindrical pedicels of the ventral ambulacra meet each other in the middle of the interambulacra, where,

however, their number is very limited. As is pointed out in the diagnosis, the larger pedicels form a distinct simple row along each side of the body. These larger pedicels have a length of 7 mm. or more, and a breadth of 1·5 mm. or less. The pedicels of the odd ambulacrum are so small that they are scarcely visible to the naked eye. The few and very scattered dorsal ambulacral appendages present, perhaps, a conical form, which, however, is by no means well marked; they do not attain the size of the large lateral pedicels above mentioned. The middle of the odd interambulacrum seems to be almost naked. The tentacles are drawn within the body, but seem to have the structure common to the Aspidochirotæ.

The calcareous ring (Pl. X. fig. 16) is devoid of any posterior prolongations. A single short ventral Polian vesicle is present. The single dorsal madreporic canal is attached to the dorsal mesentery. A bundle of short, slightly branched, slender genital tubes is situated on the left side of the dorsal mesentery. The two respiratory-trees are well developed, but are not in any intimate connection with the pseudhæmal vessels. The longitudinal muscles are simple, and there are no retractors.

The tables vary greatly in size and shape, some having a nearly regular hexagonal disk with six large peripheral holes and a central smaller hole, others having the disk smaller, irregular, with the central hole larger than the surrounding ones (Pl. X. fig. 17). The diameter of the largest disks measures about 0·12 mm., while that of the smaller is only 0·07 mm. The height of the spire (Pl. X. fig. 18) varies from 0·12 mm. to 0·18 mm. But tables are often met with which have the disks perforated with more than six peripheral holes. The pedicels and dorsal appendages (pedicels?) are strengthened by terminal plates and more or less deformed tables, but they seem in general to be devoid of transverse rods. The terminal disks of the dorsal appendages are more rudimentary. The above diagnosis and description refer to the large, well-developed individual. The smaller specimen, 57 mm. long, obtained at the same Station is much contracted and wrinkled, but here it becomes more evident that the dorsal appendages at the anterior extremity of the body are of a conical form.

The two specimens brought home from Station 298 resemble the small one obtained at Station 300; one of them, however, is devoid of deposits in the integument, probably a result of the influence of some acid in the alcohol. In the other specimen, on the contrary, the greater part of the deposits is left uninjured; they closely resemble those above described, excepting that the three teeth of the spire are less spinose. The individual deprived of deposits seems to have the dorsal ambulacral appendages more numerous and like pedicels.

Holothuria murrayi, var. *parva*, nov. (Pl. IX. fig. 2; Pl. XVI. figs. 4, 5).

Habitat.—Station 219, March 10, 1875; lat. 1° 54′ S., long. 146° 39′ 40″ E.; depth, 150 fathoms; coral mud; one individual.

There is good reason for referring this form to a new species, but considering that it presents in several respects great similarities to *Holothuria murrayi*, and that I have had at my disposal only a single specimen, I prefer for the present to regard it as a variety of this species. Length, 72 mm. Body fusiform, about 23 mm. broad at the middle. Pedicels numerous, cylindrical, about 2·5 mm. long, scattered over the dorsal surface and the sides of the body. The pedicels of the ventral surface are very minute and scarcely visible to the naked eye. Colour yellowish-white. Deposits—tables with a spire composed of three arms with spinous apices and a single transverse beam (Pl. IX. fig. 2, *a*, *b*, *c*, *d*). Pedicels apparently without transverse supporting rods but with well-developed terminal plates. Mouth turned downwards; anus terminal. A single Polian vesicle. The figures will give the best idea of the external appearance of the animal and of the shape of the deposits.

Holothuria murrayi (var.?) (Pl. IX. fig. 3).

Habitat.—Station V., January 28, 1873; lat. 35° 47′ N., long. 8° 23′ W.; depth, 1090 fathoms; bottom temperature, 38°·5; Globigerina ooze.

A single specimen, 80 mm. long, differing from the typical form principally in that the ambulacral appendages, which are evidently true pedicels, are more numerous on the dorsal surface and the sides of the body. Even the calcareous ring (Pl. IX. fig. 3) is somewhat different, which will be understood from the figures. Colour greyish, inclining to violet. From the scanty materials I could not undertake any more detailed examination, but, so far as I can judge, there can be but little doubt that this form is identical with, or at least very nearly related to those brought home from Station 300.

The three species above mentioned, viz., *Holothuria lactea*, *Holothuria thomsoni*, and *Holothuria murrayi*, form a group by themselves among the numerous representatives of the genus *Holothuria*, and it is very probable that they may be properly placed in a new genus, or, at least, in a subgenus. Indeed, *Holothuria thomsoni* differs so strikingly from all forms hitherto known that I should not hesitate to refer it to a new genus if I had not had the opportunity of examining the two other forms, which evidently form a transition to the true *Holothuriæ*. *Holothuria thomsoni* is distinguished by twelve tentacles, and its variety by fifteen, numbers of tentacles hitherto unknown in any species of *Holothuria*. That which seems to be common to the three species above mentioned and their varieties is, firstly, the conformation of the calcareous deposits, and secondly, the peculiarity that the pedicels of the two lateral ventral ambulacra either form a simple distinct row, or that, if they are more numerous and crowded, some of them are larger and more or less distinctly arranged in a row along each side of the body.

SURVEY OF THE GENERA AND SPECIES, HITHERTO KNOWN, BELONGING TO THE ASPIDOCHIROTÆ.

Family V. Aspidochirotæ.

Body with mouth and anus at opposite poles. Tentacles peltate, twenty to thirty, seldom eighteen. Ambulacral appendages—pedicels alone, or pedicels together with papillæ, or papillæ alone; the papillæ often situated on the top of warts or more or less prominent processes. Retractors absent. Calcareous ring of ten pieces, regularly devoid of posterior prolongations; the radial pieces incised anteriorly, but not pierced. The left respiratory-tree generally in communication with the pseudhæmal vessels.

Genus 1. Labidodemas, Selenka, 1867.

Tentacles twenty. Ambulacral appendages—pedicels alone (?), arranged in double rows along each ambulacrum. Interambulacra naked. The single genital bundle situated on the left side of the dorsal mesentery. Anus devoid of teeth. C-shaped deposits present or absent.

Not having had the opportunity of examining any representative of this genus, I am by no means sure of the exactness of the above diagnosis. Both Selenka and Semper speak of pedicels, and do not mention anything about papillæ. The reason I have some doubts on the nature of the ambulacral appendages, is that Selenka points out that the ventral pedicels alone are provided with terminal plates, and, above all, because Ludwig speaks of dorsal "papillæ." So far as I can see, the only character distinguishing the genus *Labidodemas* from the genus *Holothuria* is to be found in the arrangement of the pedicels, and it may be questionable whether this is satisfactory.

Labidodemas semperianum, Selenka, 1867.

Deposits—tables with the spire formed by five rods and terminating in ten teeth; smooth buttons; and numerous rods or C-shaped bodies.

Habitat.—Sandwich Islands (Selenka).

Labidodemas selenkianum, Semper, 1868.

Habitat.—Fiji Islands (Semper).

On comparing the descriptions of Semper and Selenka, it is nearly impossible to discover any differences between this species and the preceding. The

C-shaped rods, however, seem to be absent in this species (?). With regard to the arrangement of the pedicels, Selenka says that the pedicels of the odd ambulacrum and those forming the inner row on the two lateral ventral ambulacra are twice as many as those in the remaining rows. Semper, on the contrary, remarks that the ventral pedicels in his species are more crowded than those on the dorsal surface. These differences must be more plainly illustrated.

Labidodemas dubiosum, Ludwig, 1875.

The ventral "pedicels" and the dorsal "papillæ" arranged in double rows along the ambulacra. Deposits—rare, irregular, oval buttons; tables with the disk small, almost annular, and with the short spire built up of four rods and one transverse beam, and having the top terminating in about five long, simple (or bifurcate) spines.

Habitat.—Tahiti (Ludwig).

This species does not seem to be well defined from the preceding ones.

Genus 2. Stichopus, Brandt, 1835.

Tentacles eighteen to twenty. Ambulacral appendages in the shape of pedicels and papillæ; the former arranged in three more or less distinct longitudinal series on the ventral surface; the latter mostly situated on the tops of larger or smaller protuberances, forming rows along the dorsal ambulacra, or scattered all over the dorsal surface. Two bundles of genital tubes, one on each side of the dorsal mesentery. Anus devoid of calcareous teeth. C-shaped deposits often present in the perisome.

A. C-Shaped deposits present. Tentacles eighteen or twenty.

1. *Dorsal ambulacral appendages present only on the ambulacra.*

a. Deposits—C-shaped bodies; and tables of one kind consisting of a smooth, rounded, perforated disk, supporting a spire of four rods and one transverse beam; the truncated apex of the spire terminating in several teeth.

Stichopus chloronotus (subgenus *Perideris*), Brandt, 1835; Selenka, 1867; Ludwig, 1881, 1882. *Stichopus cylindricus*, Haacke, 1880.

Tentacles twenty. Papillæ on rather prominent conical warts, forming a double row along each dorsal ambulacrum, and a zigzag or double row along each side of the body. Spire of the tables terminating in eight to twelve teeth.

Habitat.—Zanzibar (Selenka), Querimba and Mozambique (Semper), Indian Ocean (Ludwig), Mauritius (Haacke, Ludwig), Macassar (Ludwig), Lugunor and Guahan (Brandt), Sandwich Islands (Selenka), Pulo Tikul, Nicobar Islands, Pelew Islands,

Molucca Islands, Navigator and Fiji Islands (according to Semper), Darros Island (Bell).

(Mus. Holm.) Several specimens from unknown localities. In addition to C-shaped deposits and tables, I find some very scattered incomplete rosettes.

Stichopus haytiensis, Semper, 1868.

Tentacles twenty. Papillæ on rather prominent protuberances, arranged in four rows along the dorsal surface. Spire of the tables terminating in twelve teeth.

Habitat.—Hayti (Semper), Puerto Cabello (Ludwig).

Differs from the preceding species apparently in that the dorsal papillæ form four simple rows, and in having the ventral pedicels sparsely distributed in "five" broad series.

Stichopus errans, Ludwig, 1875.

Tentacles nineteen. Papillæ, fewer in number, situated on low warts. Spire of the tables terminating in twelve or sixteen teeth.

Habitat.—Barbados (Ludwig).

The description is not fully satisfactory. With regard to the papillæ, Ludwig only says that they seem to belong to the ambulacra alone, but does not explain how they are arranged.

(Mus. Holm.) One specimen dredged at St. Thomas. It is very wrinkled and contracted, so that it is impossible to state the arrangement of the dorsal papillæ; as it seems to me, they are placed on low warts forming a row along the sides of the body, and possibly such warts may even be observed on the two dorsal ambulacra. I cannot decide whether or no there are small papillæ on the interambulacra. Tentacles nineteen (or eighteen ?). The radial pieces of the calcareous ring, excepting the middle ventral one, are provided with a short posterior, deeply incised prolongation. The deposits are like those described by Ludwig, excepting that the greater part of the tables are destitute of disks or have rudimentary ones. The species is possibly identical with the preceding.

b. Deposits—C-shaped bodies; tables like those in the preceding species; and large robust tables remarkable in having the conical spire terminating in a single point and possessing several transverse beams.

Stichopus horrens, Selenka, 1867.

Tentacles twenty. Papillæ on rather large conical prominences, arranged in four rows along the dorsal surface. In addition to C-shaped bodies, incomplete rosettes, and small tables, like those in the preceding species terminating in twelve to sixteen teeth, much larger tables of the same construction are found; and, besides, large robust tables with the conical spire terminating in a single point.

Habitat.—Society Islands (Selenka).

2. *Dorsal ambulacral appendages scattered on the ambulacra as well as on the interambulacra.*

a. Deposits—C-shaped bodies; tables like those in the preceding species, thus larger and smaller tables with the truncated apex terminating in several teeth, and large robust tables with the conical spire terminating in a simple point.

Stichopus godeffroyi, var. *b*, Semper, 1868.

Tentacles twenty. The dorsal appendages on the ambulacra seem to be slightly larger than those on the interambulacra, and the presence of the latter appears to be the only character distinguishing this species from *Stichopus horrens*.

Habitat.—Navigator Islands (Semper).

(Mus. Holm.) Several specimens from the Friendly Islands, Navigator Islands Fiji Islands, and Pelew Islands. A few of the dorsal papillæ run out from slightly larger protuberances, and this is especially the case with a part of those situated on the sides of the body and on the dorsal ambulacra; however, the appendages never attain any very considerable size. An arrangement in rows of the larger appendages is not very distinct. Colour in alcohol, pale yellowish-grey, with darker stains on the back; ventral surface pale. In addition to C-shaped bodies and the two kinds of tables, incomplete rosettes.

b. Deposits—C-shaped bodies; and tables of one kind, viz., those with the spire built up of four rods and one transverse beam, and terminating in several teeth.

Stichopus variegatus, Semper, 1868. *Stichopus variegatus*, var. *herrmanni*, Semper, 1868. *Stichopus naso*, Haacke, 1880 (according to Ludwig, 1883).

Tentacles twenty. The dorsal appendages small, numerous. Spire of the tables terminating in four dentate points. Incomplete rosettes present.

Habitat.—Philippine Islands (Semper), Navigator Islands (Semper), Indian Ocean (Ludwig), Timor (Ludwig), Mauritius (Haacke, Ludwig), Port Molle (Bell).

(Mus. Holm.) Three specimens, one from the Pacific Ocean and two from the Fiji Islands. The former is 140 mm. long, of a yellowish-grey colour stained with brown and with minute blackish spots on the back. One of those from Fiji is nearly a foot long and of a darker colour. As a rule, the dorsal ambulacral appendages are minute.

Stichopus fuscus, Ludwig, 1875.

Tentacles twenty. "Dorsal papillæ not disposed in distinct rows." Spire of the tables terminating in numerous short teeth (as many as twenty-four). Rosettes absent.

Habitat.—Patagonia (Ludwig).

The species is not well known, its dorsal appendages being unsatisfactorily described. It is distinguished, however, by the numerous teeth on the top of the spire and by the fact that the pedicels in the odd ambulacrum form two series.

Stichopus möbii, Semper, 1868.

Tentacles eighteen. Dorsal surface without tubercles, but with irregularly disposed papillæ. Spire of the tables terminating in four dentate points. Incomplete rosettes present.

Habitat.—West Indies (Semper).

(Mus. Holm.) One very large specimen from West Indies, about 250 mm. long. In external appearance it closely resembles the specimens of *Stichopus variegatus* from the Pacific Ocean which I have seen, and it possesses even the minute blackish points I observed in several forms of that species. Tentacles twenty, not eighteen, but I suppose the species to be capable of some variations in this respect. The middle series of pedicels is much broader than the lateral, and contains six to eight pedicels in its breadth. The dorsal papillæ are small, scattered all over the back, and placed on the top of warts, which are very low excepting round the sides of the body, where they are more prominent and resemble rounded protuberances. The tables terminate in about fifteen or eighteen spines. I cannot refrain from offering the opinion that the species in question is possibly identical with *Stichopus variegatus*, and there seem to be good grounds in support of this supposition. According to Ludwig, even *Stichopus errans* is very nearly related to it. To decide this point, it will be necessary to know to what degree the variation in the number of tentacles and in the arrangement of the ambulacral appendages is possible. The species examined by me evidently bears greater resemblance to *Stichopus variegatus* than to *Stichopus möbii*.

Stichopus naso, Semper, 1868.

Tentacles eighteen. Dorsal surface with very large conical processes, upon and between which the papillæ are situated. Body-wall exceedingly thick. The lateral series of pedicels become rudimentary anteriorly. Body distinctly quadrangular, narrower anteriorly.

Spire of the tables terminating in about twelve teeth. Incomplete rosettes present.

Habitat.—Philippine Islands (Semper, Ludwig).

c. Deposits—C-shaped bodies; and tables consisting of a cruciform four-armed disk, with the ends of the straight arms enlarged and pierced with a few holes; the spire is long, made up of four rows connected by three, four, or more transverse beams, each rod terminating in a simple point and carrying some spines.

Stichopus tizardi, Théel, 1882.

Habitat.—Færöe Channel (Theél).

When I first described this species I had only some fragments at my disposal. Lately I have received some new specimens dredged at about the same locality, but unfortunately even these are very deformed and macerated, consequently their true shape is difficult to state. The following may complete the former description. Body elongate, equally rounded at each extremity, flattened. Mouth ventral, with twenty yellow tentacles. Anus subdorsal. Dorsal surface with conical processes, few in number, of unequal size, the largest measuring 5 to 10 mm. in length; those processes which attain a greater size are thinly placed on or in the neighbourhood of the two dorsal ambulacra, while the smaller are to be found partly in very limited numbers scattered among the larger, partly more crowded, forming a simple row along the sides of the body and round its anterior extremity. The pedicels probably form a double row along each lateral ventral ambulacrum, but on the odd ambulacrum, marked out by a deep furrow, I could not convince myself of the presence of any such appendages. The calcareous ring is very reduced, in the larger specimens absent. Two genital bundles, one on each side of the dorsal mesentery. A single Polian vesicle and madreporic canal. Body-wall thick, strengthened by C-shaped bodies and tables. In some parts of the body the spires grow much larger, and possess much more numerous transverse beams; in others all the tables become very robust, with a greater number of holes in the highly dilated ends of the arms, and with the spire more irregularly developed and highly spinous. As a rule, the four rods which constitute the spire are almost parallel and provided with spines. The dorsal processes carry numerous spinous rods and tables with very long spires.

B. C-shaped bodies absent. Tentacles twenty.

1. *Dorsal ambulacral appendages on the ambulacra as well as interambulacra.*

a. Deposits—tables like those in *Stichopus tizardi*.

Stichopus natans (*Holothuria*), Sars, 1868, 1871.

Habitat.—West coast of Norway and Sognefjord (Danielssen and Koren, Storm), Lofoten, Bergen, Hardanger (Sars).

(Mus. Holm.) Three types from Norway.

The species differs from the preceding one by the lack of C-shaped deposits; for the rest they seem to be very nearly related. Even Sars states the absence of pedicels on the odd ambulacrum. Some of the dorsal processes attain a considerable length, about 23 mm., especially those situated on or near the dorsal ambulacra.

b. Deposits—tables consisting of a large, rounded, richly perforated disk, supporting a long conical spire, built up of four rods which are spinous all over their length and joined by four to five transverse beams.

Stichopus regalis (*Holothuria*), Cuvier, 1817; Selenka, 1867; Sars, 1857. *Holothuria columnæ*, Cuvier, 1817. *Holothuria triquetra*, Delle Chiaje, 1828.

Habitat.—Mediterranean Sea (Sars, Selenka, Græffe, Heller, Grube, Ludwig, &c.), Australia? (Semper), Canary Islands (Greeff), Bay of Biscay (Norman).

(Mus. Holm.) One specimen from Naples. The dorsal appendages are larger on the distinct sharp margin, which marks the transition between the dorsal and ventral surfaces, but they decrease towards the middle line of the dorsum; they never attain any greater size. In some disks of the tables I counted more than fifty holes, and, as a rule, the disks are remarkable for having a great number of holes; even the spires of the tables are characteristic in that their four rods bear spines not only at their apex but even along almost all their length. Rosettes absent.

c. Deposits—tables of two kinds, like those in *Stichopus godeffroyi*, var. *b*, thus larger and smaller tables with the truncated apex of the spire terminating in several teeth, and large robust tables with a conical spire terminating in a simple point.

Stichopus godeffroyi, Semper, 1868.

The truncated spires terminate in eight to twelve teeth. Incomplete rosettes present. Four rows of larger dorsal appendages, and numerous small ones scattered over the interambulacra.

Habitat.—Navigator Islands (Semper).

d. Deposits—tables of one kind, viz., those with the spire built up of four rods and one transverse beam (seldom two or more), and terminating in several teeth.

Stichopus godeffroyi, var. *pygmæus*, Semper, 1868.

Like the preceding species; the disks of the tables are larger.

Habitat.—Fiji Islands (Semper), Navigator Islands (Semper).

Stichopus japonicus, Selenka, 1867; von Marenzeller, 1881.

The tables are of different sizes, and their spire is mostly built up of four rods joined by one, two, or more transverse beams; the spire terminates in four

smooth or slightly spinous teeth. In addition to these deposits, Selenka mentions numerous perforated disks devoid of spires. Rosettes absent. The dorsal appendages are larger along the sides of the body, where they form a distinct row.

Habitat.—Japan (Selenka, von Marenzeller).

(Mus. Holm.) Two specimens dredged at Hong Kong, which may probably be regarded as typical. They attain a length of 200 mm. The dorsal papillæ are distributed all over the back, and some of them are situated on large conical processes, which have a length of about 17 mm. and a breadth at the base of 13 mm.; these processes form a simple row along each side of the body and a more irregular alternating double row along the dorsal ambulacra. They agree in all respects with those dredged during the Challenger Expedition, excepting that the deposits have almost exclusively the shape of perforated disks; it is very rare to find any complete tables.

Stichopus maculatus, Greeff, 1882.

Spire of the tables terminating in fourteen to sixteen external and eight internal spines or teeth. Rosettes absent. Dorsal appendages in the shape of thick, high warts, between which smaller ones are placed.

Habitat.—Rolas (Greeff).

The arrangement of the dorsal papillæ is not fully clear.

Stichopus assimilis, Bell, 1883.

Disks of the tables reduced to simple, uneven, or spinous rings, and the spire terminating in about eight (?) teeth. In addition to these deposits, flattened reticulated bars of very characteristic appearance. Rosettes absent. Dorsal papillæ abundant and well developed.

Habitat.—Angola (Bell).

The species in question is too unsatisfactorily known to decide whether it is really a distinct species. The "flattened reticulated bars" seem to be nothing other than perforated rods or bars supporting the papillæ or pedicels. A further examination will prove whether there exists any distinguishing character between this form and the preceding one.

Stichopus kefersteinii, Selenka, 1867.

Disks of the tables spinous in the margin; spire terminating in twelve teeth. Rosettes absent. Four rows of warts with papillæ along the dorsum, and scattered simple papillæ all over the back.

Habitat.—Acapulco (Selenka).

Stichopus sitchaensis (*Diploperideris*), Brandt, 1835; Ludwig, 1881. *Holothuria sitchaensis*, Stimpson, 1857.

Disks of the tables absent; spire built up of four short rods, joined by a transverse beam, each rod terminating in two or three short teeth. Rosettes absent. Dorsal appendages scattered.

Habitat.—Sitcha (Brandt, Ludwig).

The species is unsatisfactorily known.

e. Deposits—dichotomously branched, slender spicules (no true rosettes) and aggregations of innumerable minute grains.

Stichopus ananas (*Trepang*), Jæger, 1833; Semper, 1868; Ludwig, 1881. *Holothuria ananas*, Quoy and Gaimard, 1883; Selenka, 1867. *Holothuria grandis* (subgenus *Thelenota*), Brandt, 1833.

Dorsal appendages large, arranged in bundles, two to eight in each.

Habitat.—Polynesia and Java (Selenka), Celebes (Jæger), Bay of Geelvink in New Guinea (Ludwig), Carteret, New Ireland (Quoy and Gaimard), Lugunor in Caroline Island (Brandt).

(Mus. Holm.) A very large specimen, more than a foot long, from the Navigator Islands.

2. *Dorsal ambulacral appendages present only on the ambulacra.*

Stichopus badionotus, Selenka, 1867 and 1868.

Like *Stichopus chloronotus* in all respects, but distinguished by the absence of the C-shaped deposits.

Habitat.—Florida, (Acapulco ?) (Selenka).

The following species are more or less unsatisfactorily known and need re-examination :—

Stichopus armatus (*Holothuria*), Selenka, 1867; Semper, 1868.

Deposits—thinly scattered perforated disks. Rather large dorsal appendages form four irregular rows, and, besides, small scattered papillæ.

Habitat.—Hakodadi, Japan (Selenka).

The species is probably nothing else than a *Stichopus japonicus* (*?*).

Stichopus selenkæ, Barrois, 1882.

Deposits—widely open, rare C-shaped bodies; large irregularly formed, perforated plates; a few cruciform or star-like bodies, the latter with three arms.

Habitat.—Concarneau on the west coast of France (Barrois).

The description is summary and too incomplete to convey an exact idea of the animal. Barrois says that it resembles *Stichopus chloronotus* in external appearance. He does not mention anything about pedicels, papillæ, &c.

Stichopus lucifugus (*Holothuria*), Quoy and Gaimard, 1833; Brandt, 1835; Selenka, 1868.

Deposits—granulated, spinous, curved rods.

Habitat.—Carteret (Quoy and Gaimard).

Stichopus albifasciatus (*Holothuria*), Quoy and Gaimard, 1833; Brandt, 1835.

Habitat.—Tonga (Quoy and Gaimard).

Stichopus luteus (*Holothuria*), Quoy and Gaimard, 1833; Brandt, 1835; Selenka, 1868. *Holothuria monotuberculata*, Quoy and Gaimard, 1833. *Stichopus unituberculatus*, Brandt, 1835.

Habitat.—Tonga and Port Louis in Mauritius (Quoy and Gaimard), Mauritius (Hoffmann).

Stichopus sp., Bell, 1884.

Habitat.—Australia (Bell).

Allied to *Stichopus chloronotus*.

Genus 3. Mülleria, Jæger, 1833.

Tentacles twenty to twenty-seven. Ambulacral appendages in the shape of pedicels on the ventral surface and papillæ on the dorsal. Seldom an arrangement of the pedicels in longitudinal series visible. A single genital bundle present, situated on the left side of the dorsal mesentery. Anus surrounded by five calcareous teeth. No C-shaped deposits in the body-wall.

A. Tentacles twenty.

1. *Deposits—tables together with buttons or hollow fenestrated ellipsoids.*

Mülleria nobilis, Selenka, 1867 ; Semper, 1868. (?) *Holothuria maculata* (subgenus *Microthele*), Brandt, 1835 (according to Ludwig, 1881).

The robust tables have the spire terminating in sixteen to twenty teeth. The hollow fenestrated ellipsoids form a thick layer.

Habitat.—Zanzibar (Selenka), Mauritius (Haacke), Philippine Islands (Semper), Guahan (Brandt), Sandwich Islands (Selenka).

(Mus. Holm.) Some specimens from the Fiji Islands. Colour almost black, speckled with lighter tint. Dorsal papillæ more thinly scattered than the ventral pedicels, and of about the same size as or smaller than these. In the contracted state the dorsal surface seems to have some low protuberances, especially along the sides of the body. The anal teeth are small and surrounded by five groups of papillæ, each group corresponding in position with a tooth. The tables are thinly scattered, consisting of an irregularly rounded disk with smooth undulated margin and pierced with a large central and several smaller peripheral holes; the spire, formed by four rods and one transverse beam, terminates in twenty or more teeth. In one specimen it becomes evident that the papillæ partly run out from the body-wall itself, partly from more or less considerable protuberances, which for the most part are placed on the ambulacra.

Mülleria hadra, Selenka, 1867.

Habitat.—Society Islands (Selenka).

Like the preceding species, except in the conformation of the calcareous ring. According to the figures given by Selenka, the radial pieces of the ring in *Mülleria hadra* are narrower but much higher than in *Mülleria nobilis*, and possess anteriorly a single notch, while the latter species has no less than three low incisions.

Mülleria flavo-castanea, n. sp.

Deposits—tables and buttons. Disks of the tables with smooth margin and perforated with a large central hole and several smaller peripheral ones; the spire, built up of four rods and one transverse beam, terminates in twenty or more teeth. The buttons are large, oval, commonly with more than six (seven to twelve) holes; they are either completely smooth or provided with one, two, or more small elevations, which are mostly placed on the middle beam.

Habitat.—Madeira (Mus. Holm.).

Length, 100 mm. Colour—auburn, with a well-marked light yellowish space round the dorsal papillæ; papillæ themselves and pedicels dark auburn; tentacles lighter inclining to yellowish-green. Tentacles surrounded by papillæ. Anal teeth very minute, built up of a calcareous network. Pedicels crowded,

forming a kind of sole; in the space between the anus and the truncated end of the sole there are papillæ instead of pedicels. The dorsal papillæ, not so closely placed as the pedicels, are situated, apparently, on low wart-like bases. A single Polian vesicle and madreporic canal. Numerous Cuvierian tubes. The dorsal papillæ have curved spinous rods and larger irregularly rounded or oval, bilateral plates, while the pedicels are devoid of rods.

Mülleria excellens, Ludwig, 1875.

Deposits—tables and buttons. The short spire terminates in a rounded top with innumerable minute teeth; the oval buttons have six to eight holes and are finely spinose, especially round the margin.

Habitat.—Navigator Islands (Ludwig).

Mülleria parvula, Selenka, 1867. *Actinopyga parvula*, Verrill, 1867 to 1871.

Deposits—tables and buttons, the former with the truncated apex terminating in numerous teeth, the latter smooth and pierced with about six holes. Colour uniformly auburn.

Habitat.—Florida (Selenka).

As will be understood from the above descriptions, *Mülleria parvula* is distinguished from *Mülleria flavo-castanea* by the colour, by the number of holes in the buttons, by the absence of Cuvierian organs, &c. Notwithstanding this, further investigations may possibly show the former to be the young of the latter. *Mülleria excellens* differs from *Mülleria parvula* mainly in the rounded, very spinous apex of the tables as well as by the spinous buttons. Among the collections of Holothurians in the Zoological State Museum at Stockholm a small *Mülleria*, 30 mm. long, is preserved from the Navigator Islands. At first one may be inclined to refer it to *Mülleria excellens*, which lives at the same locality, but it is distinguished by the smooth buttons and in having a great part of the tables, like those in *Mülleria parvula*, provided with fewer spines in the truncated end of the spire, the rest of the tables bearing a nearer resemblance to those in *Mülleria excellens*. Either the two species of *Mülleria* are not distinct, or *Mülleria parvula* lives both in the Pacific and Atlantic Oceans—or the above-mentioned form is new to science, which seems less probable.

2. *Deposits—comparatively large* × *-shaped, slender, branched spicules, with the straight arms slightly dichotomous.*

Mülleria formosa, Selenka, 1867.

The very slender × -shaped bodies have the arms rather straight, narrow, tapered and often provided with a few spines, and aggregations of minute roundish grains. Ventral pedicels very numerous; dorsal papillæ on crowded warts.

Habitat.—Macassar (Selenka), Mauritius (Haacke).

3. *Deposits—simple rods, or minute* × *-shaped bodies often with the short arms more or less dichotomous and dilated so as to give the aspect of incomplete rosettes.*

Mülleria obesa, Selenka, 1867.

Deposits—finely granulated simple rods.
Habitat.—Sandwich Islands (Selenka).

Mülleria miliaris (*Holothuria*), Quoy and Gaimard, 1833; Brandt, 1835; Selenka, 1867. *Holothuria lineolata*, Guoy and Gaimard, 1833. *Mülleria lineolata*, Brandt, 1835. *Mülleria plebeja*, Selenka, 1867 and 1868.

Deposits—minute rods with the ends slightly dichotomously branched, often presenting themselves under the shape of × or incomplete rosettes. Pedicels forming three more or less distinct series.

Habitat.—Zanzibar (Selenka), Tonga and Vanikoro (Quoy and Gaimard), Indian Ocean (Ludwig), Nossibé in Madagascar (Ludwig), Mauritius (Haacke, Ludwig), Amboina, Timor and Padang in Sumatra (Ludwig), Mozambique and Querimba (Semper), Red Sea (Ludwig).

(Mus. Holm.) One specimen from Penope and four from the Fiji Islands, all of a dark chocolate-brown colour, with the pedicels in more or less obvious rows. The minute incomplete rosettes are all of the same size, few and scattered and not collected in groups.

Mülleria lecanora, Jæger, 1833; Semper, 1868; Ludwig, 1881. *Holothuria dubia* (subgenus *Microthele*), Brandt, 1835. *Actinopyga lecanora*, Bronn, 1860.

Almost like the preceding species, but the colour on the dorsal surface is always well marked out from that on the ventral, and the anus is always surrounded by a well-defined lighter space.

Habitat.—Philippine Islands (Semper), Celebes (Jæger), Bonin Islands (Brandt), Timor (Ludwig), Mauritius (Haacke, Ludwig).

(Mus. Holm.) One specimen (170 mm. long) from Tongatabu, one from Mauritius, and a third from the Fiji Islands. Dorsal surface uniformly chocolate coloured; ventral surface and a well-defined space round the anus lighter, inclining to yellowish. Pedicels more crowded along the ambulacra, so that an arrangement in three longitudinal series becomes discernible. The dorsal papillæ thinly scattered and small. No supporting rods in the pedicels and papillæ. The incomplete rosettes in the perisome are minute, of nearly equal size, resembling those in the preceding species, but in *Mulleria lecanora* they always seem to be collected in small closely placed groups. The individual dredged at Mauritius has the dorsal surface marbled by means of the small papillæ which are surrounded by a whitish space. There is no doubt that the species in question is very nearly allied to the preceding.

Mülleria echinites, Jæger, 1833; Semper, 1868.

Deposits—small incomplete rosettes, and large simple or irregularly branched rods, having, like the former, the ends of the arms dichotomous.

Habitat.—Indian Ocean (Ludwig), Celebes (Jæger), Padang in Sumatra (Ludwig).

(Mus. Holm.) One specimen from the Fiji Islands. Length, 140 to 150 mm. Colour in alcohol, blackish-brown, with the pedicels, papillæ, and tentacles lighter. Tentacles twenty. Anal teeth of ordinary size. Mouth ventral in position, surrounded by a brim of small papillæ. The ventral cylindrical pedicels very distinctly arranged in three series, though a few pedicels may be found even on the interambulacra. Dorsal papillæ small, not larger than the pedicels, closely placed, and seemingly issuing from minute warts. Deposits crowded, of two kinds —large rod-like bodies, mostly unbranched, or with the ends alone dichotomously branched; and small dichotomously branched incomplete rosettes of the usual shape. There exist great variations in size between these two extremes, but a good many transitional forms may be found among them. The papillæ have very rudimentary terminal plates. The species evidently bears the nearest resemblance to *Mülleria miliaris* and *Mülleria lecanora*.

B. Tentacles twenty-five to twenty-seven.

Mülleria mauritiana (*Holothuria*), Quoy and Gaimard, 1833; Brandt, 1835; Selenka, 1868. *Mülleria varians*, Selenka, 1867.

Tentacles twenty-five. Deposits—in the dorsal integument longer and shorter rods with small processes running out from the sides, and with the ends spinous or more or less distinctly dichotomous; in the ventral perisome small smooth oval grains and larger smooth unbranched rods with the ends slightly rough.

Habitat.—Philippine Islands (Semper), Society Islands (Selenka), Navigator Islands (Semper), Fiji Islands and Sandwich Islands (Selenka), Querimba and Red Sea (Semper), Mauritius (Quoy and Gaimard, Haacke, Ludwig), Amboina, Java, Padang, Pulo Penang (Ludwig), Mozambique, Darros Island, and (?) Amirante Islands (Bell).

(Mus. Holm.) Several individuals from Pulo Penang, Navigator Islands, Fiji Islands, Tahiti, Marquesas, Paumatu, Apia, and Eooa. Tentacles varying from twenty-four to twenty-six. The largest specimen attains a length of 160 mm. Colour auburn, lighter on the ventral surface; white rings surrounding the bases of the papillæ, especially obvious on the sides of the body, and in the neighbourhood of the anus. Pedicels very crowded, not arranged in distinct series. The conical dorsal papillæ are of about the same size as the pedicels. Deposits of the dorsal surface—incomplete rosettes; and numerous elongate rods which are granulated or provided with numerous crowded simple or branched, unequal protuberances. Deposits of the ventral surface—more or less complete rosettes; numerous elliptic bodies which are smooth or provided with incisions; and rods resembling those in the dorsal perisome, but smooth or with less prominent protuberances.

Mülleria agassizii, Selenka, 1867. *Actinopyga agassizii*, Verrill, 1867–1871.

Tentacles twenty-five to twenty-seven. Deposits—in the dorsal perisome minute ×-shaped bodies, in the ventral minute simple rods. Pedicels in three longitudinal series.

Habitat.—Florida, Tortugas and Hayti (Selenka).

Possibly only a variety of the former.

Mülleria guamensis (*Holothuria*), Quoy and Gaimard, 1833; Brandt, 1835.

Habitat.—Guam (Quoy and Gaimard).

Tentacles twenty-six. A very dubious form, which needs re-examination.

Mülleria sp., Walter, 1885.

Habitat.—Ceylon (Walter).

Genus 4. Holothuria, Linné, 1758.

Tentacles twenty, exceptionally more or less. Ambulacral appendages—pedicels alone or papillæ alone, or both papillæ and pedicels; the former placed on the dorsal surface, the latter on the ventral. These ventral pedicels are seldom arranged in longitudinal series. A single bundle of genital tubes situated on the left side of the dorsal mesentery. Anus devoid of calcareous teeth, but sometimes stellate. C-shaped deposits absent.

A. Deposits—more or less incomplete rosettes.

I. Anus more distinctly stellate.

Holothuria marmorata (*Bohadschia*), Jæger, 1833; Semper, 1868; Ludwig, 1881. *Sporadipus ualanensis* (subgenus *Colpochirota*), Brandt, 1835. *Holothuria ualensis*, Selenka, 1867. *Holothuria brandtii*, Selenka, 1867 and 1868. *Holothuria utrimquestigmosa*, Haacke, 1880 (according to Ludwig, 1881).

Habitat.—Philippine Islands (Semper), Nicobar Islands (Semper), Java (Selenka), Celebes (Jæger), Fiji Islands (Semper), Amboina (Ludwig), Geelvink Bay at New Guinea (Ludwig), Mauritius (Haacke and Ludwig), Bonin Islands (Semper), Ualan in Caroline Islands (Brandt).

(Mus. Holm.) One specimen brought home from Mauritius. Length, 120 mm. Colour—dorsal surface auburn, with some large spots or bands of yellowish-white colour, ventral surface yellowish-white; here and there, especially along the sides of the body, a large darker violet spot may be found within a light yellowish space. The ambulacral appendages have the shape of cylindrical pedicels, which, however, are smaller on the dorsal surface.

These pedicels are supported by a well-developed terminal plate and numerous transverse rods. Scattered among the dorsal pedicels other ambulacral appendages may be seen, which, being slightly larger than the dorsal pedicels themselves, present an obvious conical form, and may evidently be regarded as papillæ. These papillæ are supported by a great number of rods, but their terminal plates are very reduced. According to Selenka, the ambulacral appendages are devoid of supporting rods. The rosettes in the body-wall itself are mostly very incompletely developed, either resembling simple × -shaped bodies, or oval grains with incisions at their middle, or rounded grains with or without perforations, or even rods with a series of rounded prominences on each side. A single Polian vesicle and madreporic canal. The anterior portion of the interradial pieces of the calcareous ring is rounded and head-like. Cuvierian organs well developed. Anus stellate owing to five groups of small papillæ, five papillæ in each.

Holothuria argus (*Bohadschia*), Jæger, 1833 ; Semper, 1868.

Habitat.—Celebes (Jæger), Society Islands (Ludwig), Navigator Islands (Semper), Timor, Waygeou and Padang at Sumatra (Ludwig).

(Mus. Holm.) One specimen from the Fiji Islands. Length, 125 mm. Colour—ventral surface uniformly brown ; dorsal surface dark olivaceous, here and there lighter, with numerous large almost black, sharply marked circles. Often two or more circles are united so as to form irregular figures. The circles are always surrounded by a whitish space, measuring about 5 mm. in diameter, and their centre where the papillæ issue is darker than the rest of the space enclosed within them. Though these circles are mainly collected along the sides of the body and on the dorsal ambulacra, they are to be found also in the interambulacra, consequently no distinct longitudinal series are visible. The ventral pedicels seem to be slightly more crowded and larger than the dorsal. In the middle of each "circle" an ambulacral appendage is situated, which has a conical form and bears a rudimentary terminal plate. The pedicels as well as the "papillæ" are strengthened by supporting rods. The anus is not very distinctly stellate. So far as I can find, the differences between this species and the preceding are very unimportant and mainly confined to the colour and the calcareous ring, the latter being many times larger and very solid in *Holothuria marmorata*.

Holothuria vitiensis, Semper, 1868.

Pedicels numerous, equally distributed all over the body. Colour—light brown, darker at the base of the pedicels. Incomplete rosettes like those in the preceding forms.

Habitat.—Nicobar Islands, Navigator Islands, Fiji Islands (Semper).

(Mus. Holm.) Two individuals brought home from the Fiji Islands and New Britain ; the former is light greyish or yellowish-brown, with a few larger dark spots or

bands; the latter is of a dark reddish-brown colour and measures about 180 mm. in length. Even here I found among the dorsal pedicels some appendages, which are conical and possess a rudimentary terminal plate. In the specimen from the Fiji Islands the anus is very distinctly stellate. I must confess I cannot distinguish this form from the two preceding ones. They are most probably only varieties of one and the same species.

II. Anus indistinctly or not at all stellate.

Holothuria tenuissima, Semper, 1868.

Anus slightly stellate owing to five groups of papillæ. Pedicels all over the body. Deposits—incomplete rosettes like those in the above mentioned forms; some of them possibly more resembling minute slightly branched rods.

Habitat.—Bohol and Navigator Islands (Semper), Indian Ocean, Timor and Padang (Ludwig).

(Mus. Holm.) One individual agreeing in all respects with the description of Semper. Semper himself says that no other difference exists between this form and *Holothuria vitiensis* than that of the arrangement of the Cuvierian tubes, and he therefore seems very much inclined to refer them to the same species.

Holothuria koellikeri, Semper, 1868.

Habitat.—Navigator Islands (Semper).

Scarcely to be distinguished from the preceding species. The anus does not seem to be stellate.

Holothuria clemens, Ludwig, 1875.

Habitat.—Navigator Islands (Ludwig).

Anus surrounded by fifteen small papillæ. Is scarcely to be distinguished from *Holothuria tenuissima* or *Holothuria koellikeri*, to which forms it bears the nearest resemblance.

Holothuria similis, Semper, 1868.

Habitat.—Bohol (Semper).

According to Semper, fine papillæ exist all over the body. For the rest, I cannot find any character of such importance as to justify its being regarded as a distinct species. I feel almost convinced myself that we have to do with a single species or with a few species capable of great variations, and that most of the above seven species may be justly considered as young or varieties.

B. Deposits—simple or branched rods, the branches being sometimes united, the rods then acquiring the shape of irregular perforated plates.

Holothuria glaberrima, Selenka, 1867.

Ventral pedicels very numerous; dorsal pedicels more thinly scattered. Anus fringed with papillæ. Deposits—minute narrow rods with the ends slightly parted; and minute ×-shaped bodies with the ends of the arms carrying processes.

Habitat.—Hayti, Bahama Islands and Panama (Selenka), Surinam (Semper), Mazatlan (Semper).

Semper refers this species to that group which is characterised by the dorsal ambulacral appendages being transformed into papillæ.

Holothuria lubrica, Selenka, 1867.

Ventral pedicels more numerous than the dorsal "wart-pedicels." Deposits—spinous curved rods.

Habitat.—Acapulco (Selenka), Sanghir (Ludwig), Mazatlan (Semper).

(Mus. Holm.) Numerous specimens brought home from St. Bartholomew, which may be referred to this species or to the preceding one. At the same time it seems very possible that they are identical with Lesueur's *Holothuria obscura*, dredged at the same locality; at least there is nothing which disagrees with the summary description of this author. Colour—dark brown, lighter on the ventral surface; inner surface of the perisome with blackish spots. Anus fringed with small elongate papillæ. The ventral pedicels much more crowded than the dorsal, whereby a line of demarcation becomes visible on the transition between the two surfaces. Very often a narrow naked space is to be seen along the odd ambulacrum, separating the ventral pedicels into two longitudinal series. It seems somewhat uncertain whether the dorsal appendages are to be regarded as papillæ or pedicels; like the ventral ones, they have a distinct, though smaller sucking-disk and a well-developed terminal plate. In some individuals they are more obviously cylindrical than in others, and in the very same specimen some are cylindrical others more elongate conical, with smaller sucking-disk. The dorsal sucking-disks are dark, while the larger ventral ones are pale. With regard to the calcareous ring, deposits, Polian vesicles, and madreporic canals, the specimens from St. Bartholomew closely resemble *Holothuria lubrica*. The calcareous rods have a more or less rough surface, are often not very distinctly curved, and have the ends slightly spinous. In the larger specimens some Cuvierian tubes are present.

Holothuria moebii, Ludwig, 1883.

Ventral pedicels more numerous than the dorsal papillæ. Deposits—numerous finely granulated rods, and, besides, in the ventral perisome quite smooth rods.

Habitat.—Hong Kong (Ludwig).

Nearly allied to the preceding species, but differing from it in the structure of the rods as well as by the presence of H-shaped supporting rods in the ventral pedicels.

(Mus. Holm.) One individual brought home from Mauritius.

Holothuria erinaceus, Semper, 1868. *Holothuria erinaceus*, var. *pygmæa*, Semper, 188.

Ventral pedicels numerous; dorsal papillæ fine and even closely placed. Deposits—numerous rods provided with spines or prominences and slightly branched at the ends.

Habitat.—Bohol and Luzon (Semper), Fiji Islands (Semper), Port Mackay (Semper).

Semper supposes the species to be very nearly related to *Holothuria glaberrima* and possibly identical with it. He even speaks of some young, which are said to have the ventral pedicels disposed in more or less distinct rows, and possess tables besides the rods, which tables vanish as the individual grows larger. It seems more probable that these "young" belong to another species.

(Mus. Holm.) Two specimens obtained at the Fiji Islands, the largest 200 mm. long, of a dark brown colour inclining to blackish; ventral surface lighter; pedicels light yellowish-brown. The dorsal papillæ small, not so crowded as the pedicels. The calcareous rods bear a few spines on their sides, and their ends are slightly branched or perforated. Excepting terminal plates, no other deposits.

Holothuria paradoxa, Selenka, 1867.

Ventral pedicels more numerous than the dorsal, which may be of the same kind. Deposits—in the ventral perisome smooth rods and × -shaped bodies, the arms of the latter being branched and often united so that the bodies take the shape of small perforated plates; in the dorsum more finely constructed × -shaped bodies alone are to be found.

Habitat.—Sandwich Islands (Selenka).

Doubtless closely allied to *Holothuria glaberrima*, from which it differs in some characters of more or less importance. Thus, the madreporic canal is free in *Holothuria glaberrima* but attached in *Holothuria paradoxa*; in the former the

radial pieces of the calcareous ring are more than twice as large as the interradial, while in the latter they are of nearly equal size. Even the deposits in the body-wall present some small differences.

Holothuria marenzelleri, Ludwig, 1883.

Ventral pedicels more numerous and with larger disks than the dorsal, which on the other hand run out from slightly larger warts than the former. Deposits—flat rods with short, mostly dichotomous branches in the margin, these branches being sometimes united so as to form holes, the rods themselves thus acquiring the aspect of irregular plates with the margin uneven or spinous and perforated by two to six or more asymmetrical holes.

Habitat.—Nangkauri (Ludwig).

(Mus. Holm.) One individual from Nangkauri, agreeing in all respects with the description of Ludwig. It is, however, impossible to distinguish any arrangement of the ventral pedicels in rows—as stated by Ludwig—nor whether they are placed on low warts, which, on the contrary, is the case with the dorsal. All the pedicels, being true pedicels, are exactly like one another, excepting that the dorsal have a smaller disk and are possibly slightly conical. Anus fringed with small fine papillæ.

C. Deposits—tables alone in a higher or lower state of development.

I. Tables incomplete, either the spire or the disk being absent or highly reduced.

Holothuria catanensis, Grube, 1840, 1864; Semper, 1868; Heller, 1868.

Dorsal papillæ small, indistinctly disposed in seven irregular rows. Ventral pedicels indistinctly arranged in three longitudinal series. Deposits—very small and thinly scattered, rounded disks of tables alone, pierced with four holes; the spire is absent or rudimentary.

Habitat.—Mediterranean Sea (Grube, Heller, von Marenzeller, Græffe, Ludwig), Portinho (Greeff).

Von Marenzeller kindly sent me three specimens dredged at Lesina. Two are blackish-brown, the remaining one is lighter. The dorsal papillæ seem to be situated on low warts, and do not present any arrangement in rows. The minute and very thinly scattered disks of the tables often carry four short spines, showing traces of a spire. The pedicels have a large terminal plate surrounded by a few slender, slightly spinous rods, with the ends dilated and perforated; besides which, the "disks" are more frequent in the pedicels than in the body-wall itself. The papillæ are supported by a very rudimentary terminal plate and numerous crowded, solid, and nearly smooth rods with the ends spinous, or branched, or perforated. In the papillæ I have found disks with nearly complete spires.

Holothuria languens, Selenka, 1867.

Pedicels all over the body. Tables consisting of a spire alone, built up of four rods and one transverse beam; the spire bears spines at the annular base and round the truncated top.

Habitat.—Panama (Selenka), Surinam and British Guiana (Semper).

Holothuria dietrichii, Ludwig, 1875.

Pedicels all over the body. The oval or rounded smooth disks of the tables are regularly perforated with four holes, and support a spire reduced to two rods anastomosing near the free ends.

Habitat.—Bowen and Hong Kong (Ludwig).

The tentacles, calcareous ring, &c., were destroyed in the specimens examined by Ludwig.

II. Tables complete, but with the disks small, annular and spinous in the margin.

Holothuria pertinax, Ludwig, 1875.

The ventral pedicels forming a simple row along each side and a double one along the middle. Dorsal papillæ irregularly scattered. Tables equally broad and high; the short spire is made up of four rods and one transverse beam, and its truncated top terminates in teeth.

Habitat.—Navigator Islands (Ludwig).

Even the calcareous ring is of uncommon construction, its interradial pieces being transformed into very slender narrow curved bands, much longer than the radial.

Holothuria imitans, Ludwig, 1875.

Ventral pedicels and dorsal papillæ scattered. The elongate spire built up of four rods and one transverse beam, with the rounded top carrying spines or teeth.

Habitat.—Navigator Islands (Ludwig).

III. Tables complete, made up of a smooth, usually well-developed, perforated disk supporting a distinct spire.

Holothuria modesta, Ludwig, 1875.

Papillæ all over the body. The roundish smooth disk of the tables is pierced with about eight holes, and carries a long conical spire made up of four rods and several—about four—transverse beams; the top of the spire terminating in several teeth.

Habitat.—Cape York (Ludwig), (?) Torres Strait (Bell).

According to Ludwig, like *Holothuria martensii* in internal and external organisation.

Holothuria intestinalis, Ascanius and Rathke, 1767; Düben and Koren, 1844. *Thyonidium scabrum*, Sars, 1868 (according to O. Sars, 1871). *Holothuria mollis*, Sars, 1835.

Pedicels alone. The tables are very regularly formed, consisting of a circular disk with smooth though undulated margin, and pierced with a large central hole surrounded by a simple or double circle of smaller peripheric holes; the spire is built up of four rods and one transverse beam, and terminates in sixteen or more teeth.

Habitat.—Scandinavia from the Sound to Finmark (Düben and Koren, Danielssen and Koren, Möbius and Bütschli, Ludwig, Sars), White Sea (Jarzynsky), British Islands (Forbes and Goodsir).

(Mus. Holm.) A great number of specimens from different localities of Scandinavia. I am inclined to regard all the ambulacral appendages as pedicels. They are cylindrical or conico-cylindrical, with sucking-disks and terminal plates, but devoid of supporting rods. Along the sides of the body they are longest, 7 to 8 mm., but decrease towards the middle of the back in a more or less obvious manner. On the ventral surface, on the contrary, the pedicels are scattered and very minute, nearly inconspicuous, and reduced, apparently, to a disk with distinct terminal plate. To judge from the description of Düben and Koren, they must have confounded the dorsal and ventral surfaces.

Holothuria magellani, Ludwig, 1883.

Habitat.—Strait of Magellan (Ludwig).

This species is doubtless very nearly related to the preceding one, and it seems almost impossible to point out any distinguishing character of importance. According to Ludwig, the odd ambulacrum is almost devoid of pedicels, and the dorsal surface carries thinly scattered small "papillæ," while the lateral ventral ambulacra have a double row of well-developed pedicels.

D. Deposits—tables in a higher or lower state of development, in company with simple or branched rods or fenestrated more or less irregular plates.

I. Tables very much transformed, devoid of disks, and with a long irregular spire of a more uncommon shape.

Holothuria gräffei, Semper, 1868.

Ventral pedicels in three distinct longitudinal series. Dorsal papillæ large, scattered. Deposits—besides tables, rosettes and irregularly branched, plate-like bodies. Tentacles twenty-four to twenty-five.

Habitat.—Philippine Islands, Molucca Islands, and Fiji Islands (Semper), Timor (Ludwig).

The description of the tables and the figures given by Semper are not fully comprehensible. The species is characterised by having more than twenty tentacles.

II. Tables of a more common shape, with the disk mostly small, annular, or completely reduced, and with a spire built up of four rods and one transverse beam.

1. *In addition to tables with completely reduced disks, large characteristic unbranched bars, more or less richly covered with protuberances or small elevations.*

Holothuria flavo-maculata, Semper, 1868.

Ambulacral appendages—pedicels alone. Only the spire of the tables is left. The four rods which constitute the spire are united at the base so as to form a rounded conical top instead of a disk; near this top each rod seems to bear a small spine. The opposite ends of the rods, which form the truncated outwardly directed part of the spire, terminate each in four diverging teeth. The bars are large, elongate, fusiform, thick at the middle, and rough from numerous small protuberances.

Habitat.—Navigator Islands (Semper).

A comparison of the above description of the tables with the figure drawn by Semper suggests the idea that Semper saw the tables with the upper part undermost, a supposition founded on reasons given under the next species. Possibly the same is the case with Ludwig's *Holothuria imitans*, which agrees in most respects with this species, but differs from it in having the characteristic rough bars only present in the ambulacral appendages.

Holothuria surinamensis, Ludwig, 1875.

Ventral pedicels more numerous than the dorsal papillæ. Deposits almost like those in the preceding species.

Habitat.—Surinam (Ludwig).

When comparing the descriptions of Semper and Ludwig, one can scarcely detect any characters to distinguish this species from the preceding, except differences in the ambulacral appendages and number of madreporic canals and Polian vesicles. As will be seen below, there exist, however, some differences even in the shape of the calcareous bars. Since I have had the opportunity of examining four specimens of *Holothuria surinamensis* dredged at Mexico, and kept in the Zoological State Museum at Stockholm, I am able to complete the description of Ludwig. The largest specimen attains a length of 200 mm., and agrees in all respects with Ludwig's types. Colour—dark rusty-brown, inclining to greyish on the ventral surface; ends of the pedicels whitish; papillæ and a small space round their base light yellowish rusty-brown; numerous well marked dark brown spots on the back. Anus with five not very distinct groups of papillæ. The numerous tables bear the closest resemblance to those figured by Ludwig as well as to those in *Holothuria flavo-maculata*, but Ludwig, and

almost certainly Semper also, have drawn the tables with the spinous truncated end downwards, supposing the conical top, which carries a few minute spines, or none, to be directed outwards from the skin. This may, however, be wrong. The tables are totally destitute of disks, the four rods being bent inwards and united at the pointed or rounded base; near the base, each of the four rods constituting the spire often carries a small spine. At the middle the spire has a transverse beam, and its outwardly directed, truncated top bears eight to twelve double teeth. Supposing that even Semper is mistaken when he states the spinous ends to be the disks of the tables, there is evidently the greatest conformity in the tables of the two species in question. With regard to the bars, on the contrary, there exist some small differences. Those in *Holothuria surinamensis* are even elongate and of solid construction, but carry along each side only a series of processes, which often become combined with each other towards the ends of the bars, so as to form some small holes on each side; these bars often bear near their extremities some minute rough elevations on their upper and under surfaces, but, for the rest, they seem to be quite smooth. Even the pedicels and papillæ are supported by such bars, which are slightly stronger and have the processes more commonly united with each other, thus forming more perforations than in the bars of the body-wall itself.

Holothuria fusco-coerulea, n. sp.

Ventral pedicels and dorsal papillæ. Deposits like those in *Holothuria flavo-maculata* above described. Tentacles twenty-nine.

Habitat.—Tahiti (Mus. Holm.).

The species is certainly closely allied to *Holothuria flavo-maculata*, but is distinguished by the uncommon number of tentacles and the shape of the ambulacral appendages. Body cylindrical. Anus round, with five pairs of small papillæ. The ambulacral appendages are small, of almost equal size, and more thinly scattered; the dorsal ones are obviously of a conical form, while the ventral are cylindrical. Anteriorly, and still more posteriorly on the ventral surface, conical papillæ are placed. The tentacles are surrounded by a brim of papillæ. The figure drawn by Semper, turned upside down, gives a very correct idea of the shape of the tables. The elongate, cylindrical or fusiform, densely knobbed or spinous bars closely resemble those in Semper's species. The conical papillæ are strengthened by a very rudimentary terminal plate and some slightly curved and spinous rods, which sometimes have the ends slightly branched or perforated. The pedicels possess a comparatively large terminal plate, and a number of irregularly perforated elongate plates. Besides these deposits, the pedicels and papillæ contain numerous crowded tables and spinous rods of the same kind as those in the body-wall itself. There are two long slender Polian vesicles and three madreporic canals. Colour—blackish, inclining to bluish tentacles light brownish or yellowish; pedicels and papillæ yellowish-brown.

2. *In addition to tables with a simple annular disk or with a more or less well-developed perforated one, simple or branched rods but no plates.*

Holothuria tremula, Gunner, 1767; Düben and Koren, 1844; Selenka, 1867. *Holothuria elegans*, O. F. Müller, 1788–1806. *Fistularia elegans*, Lamarck, 1815-1822. *Holothuria* (subgenus *Thelenota*) *elegans*, Brandt, 1835.

The dorsal papillæ are conical, while the ventral have a more cylindrical or conico-cylindrical appearance. Disks of the tables well developed, rarely or never smooth on the margin, but mostly spinous or angular, and pierced with a varying number of rather large angular holes; the spire terminates in numerous teeth arranged in two crowns. The rods are of two kinds—solid, simple or branched, more or less spinous; and delicate, slender, spinous branched ones.

Habitat.—Coast of Scandinavia, from the Cattegat to Drontheim (Sars, Düben and Koren, Danielssen and Koren, O. F. Müller, Ludwig, Möbius and Bütschli), between Norway and Shetland (Hoffmann), Bay of Biscay (Norman).

(Mus. Holm.) A very great number of specimens from Sweden and Norway. The red colour vanishes in alcohol, but the minute dark dots remain especially on the dorsal surface. Mouth surrounded by a distinct crown of papillæ arranged in about two circles. The dorsal conical papillæ have broad bases. The ventral cylindrical appendages have distinct sucking-disks and terminal plates, much larger than those of the dorsal papillæ, and they may be regarded as pedicels rather than as true papillæ. Sometimes they are more closely placed on the three ventral ambulacra, and sometimes they seem to be smaller on the odd ambulacrum. The tables do not at all resemble the figure drawn by Selenka, but the drawings of Düben and Koren give a better idea of their true shape. The perforated disks are very delicate, and the numerous teeth on the top of the spire form two crowns, the lower of which is situated just at the transverse beam, and contains eight to twelve teeth; the higher placed crown, forming the top itself of the spire, has about sixteen teeth or more. The simple or branched rods are not equally distributed all over the body; they seem always to be present in the neighbourhood of the ambulacral appendages.

Holothuria pulchella, Selenka, 1867; Ludwig, 1881. *Stichopus* (subgenus *Gymnochirota*) *cinerascens*, Brandt, 1835.

The ventral pedicels are much more crowded than the small dorsal papillæ. The spire of the tables is supported by a reduced almost annular disk, and carries twelve teeth on the top. The rods are slightly curved and finely granulated.

Habitat.—Sandwich Islands (Selenka), Philippine Islands (Semper), Sunda Islands and Java (Semper), Mozambique (Semper), Tahiti, Batjan, and Navigator Islands (Semper), Boninsima (Brandt), Enosima (von Marenzeller), Mauritius (Haacke, Ludwig).

(Mus. Holm.) Four specimens from Tahiti and one from Marquesas, agreeing in all respects with the description of Selenka. The rods are very characteristic, commonly more or less curved and finely granulated, often with the ends more rough and slightly branched. Even the supporting rods of the pedicels and papillæ are of the same kind. The number of Polian vesicles and madreporic canals is very variable; thus I counted in one specimen as many as eleven Polian vesicles and two free madreporic canals, and in another three to four madreporic canals in a bundle.

Holothuria pervicax, Selenka, 1867; Ludwig, 1883. *Holothuria depressa*, Ludwig, 1875. *Holothuria mammiculata*, Haacke, 1880.

The ventral pedicels are more crowded than the dorsal papillæ. The tables are not very well developed, their spire being often more or less reduced, short, and terminating in four simple teeth; the disks are small, rounded, smooth or slightly uneven on the margin. The small, more or less elongate rods are characterised by being uneven and warted, or distinctly undulated, or deeply incised so as to form a row of loops or holes along each side.

Habitat.—Tahiti, Pelew Islands, and Philippine Islands (Ludwig), Sandwich Islands (Selenka), Zanzibar (Selenka), Mauritius (Haacke, Ludwig), Australia, Red Sea, and Navigator Islands (Semper).

(Mus. Holm.) One specimen, 70 mm. long, from the Navigator Islands. Colour in alcohol, greyish-brown with some darker transverse bands on the back. The pedicels and papillæ are of about the same size. The tables have often a rudimentary spire. The rods present examples of transitional forms between simple rods and "buttons." Pedicels and papillæ with numerous, slightly curved rods provided with spines. These rods have often a complete or incomplete series of holes along one or both sides, or only at the ends. Terminal plates of the papillæ very rudimentary.

3. *In addition to tables with a small annular disk or with a slightly more developed perforated one, fenestrated plates mostly of irregular shape.*

Holothuria atra, Jæger, 1833; Semper, 1868; Ludwig, 1881. *Holothuria* (subgenus *Microthele*) *affinis*, Brandt, 1835. *Holothuria floridana*, Pourtalès, 1851; Selenka, 1867. (?) *Holothuria radackensis*, Chamisso and Eysenhardt, 1821.

The dorsal papillæ and ventral pedicels of nearly equal size. Disks of the tables forming a simple ring, often with a small hole at the base of each vertical rod; spire terminating in eight horizontal and four vertical, rather long teeth. The small fenestrated plates are evenly rounded or undulated on the margin; they are often undeveloped, ×-shaped with the arms slightly branched.

Habitat.—Celebes (Jæger), Florida (Pourtalès, Selenka), Zanzibar, Java (Selenka),

Madagascar (Ludwig), Djedda, Red Sea and Indian Ocean (Ludwig), Querimba, Red Sea (Semper), Ualan (Brandt), (?) Radack Islands (Chamisso and Eysenhardt), Sandwich Islands and Society Islands (Selenka), Philippine Islands, Navigator Islands, Fiji Islands, Nicobar Islands, Amboina, Batchian, Molucca Islands (Semper), Macassar, Timor, Padang, and Pulo Tibul (Ludwig), Havana, Jamaica, and Tahiti (Ludwig), Darros Island (Bell).

(Mus. Holm.) Several specimens from Tonga, Fiji Islands, and Penope. As a rule the specimens are supported by tables, which have the small annular disk smooth, but I even found, not unfrequently in the very same specimen, disks with spines on the margin.

Holothuria atra, var. *amboinensis*. *Holothuria atra*, Selenka, 1867. *Holothuria amboinensis*, Semper, 1868.

Habitat.—Amboina (Selenka), Puerto Cabello in Venezuela (Ludwig), Mozambique (Bell).

This form is scarcely distinct from the preceding species, from which it differs mainly in the fact that the annular disk bears spines; but even *Holothuria atra* has sometimes such spines.

(Mus. Holm.) One specimen, 350 mm. long, from Tonga exactly resembles *Holothuria coluber* of Semper in external appearance. Colour almost black; tentacles, pedicels, and papillæ light yellowish-brown. Four slender Polian vesicles and a single madreporic canal with elongate bipartite tubercle. Calcareous ring of the usual shape and size. Disks of the tables slightly better developed than in Selenka's *Holothuria atra*, and with larger spines on the margin; the spire with eight to twelve teeth at the top.

Holothuria pulla, Selenka, 1867; Ludwig, 1881. (?) *Holothuria* (subgenus *Microthele*) *æthiops*, Brandt, 1835.

Habitat.—Amboina (Selenka), Ualan (Brandt), (?) Ugi Australia, and (?) Mozambique (Bell).

Almost completely like *Holothuria atra;* differs from it by possessing Cuvierian tubes, a character of very subordinate importance considering the well-known fact that individuals of the very same species vary greatly in this respect.

Holothuria grisea, Selenka, 1867.

Habitat.—Hayti (Selenka), Surinam and Rio Janeiro (Semper), St. Thomé and Rolas (Greeff), Brazil (Ludwig).

Differs from *Holothuria atra* principally in the fact that the fenestrated plates are collected in circles in the integument.

(Mus. Holm.) One specimen from Brazil. Length, 135 mm. Tentacles twenty-one, the ventral slightly smaller. Ventral pedicels more densely crowded than the dorsal papillæ, which are placed on low warts. Colour in

alcohol, greyish-brown, speckled with light grey; ventral surface lighter, and pedicels yellowish-brown. Three Polian vesicles and a single free, slender madreporic canal, 20 mm. in length. The interradial pieces of the calcareous ring are comparatively narrow. The scattered tables have their disks reduced to a simple ring, which, however, contrary to what is indicated in the figure given by Selenka, is often provided with spines; their spire terminates in twelve large teeth. The circles of small fenestrated plates present themselves to the naked eye as very minute white spots. The papillæ have a very rudimentary terminal plate and slightly curved, almost smooth rods, with the ends enlarged and perforated. Excepting a well-developed terminal plate, the pedicels contain very few such rods, which sometimes are transformed into perforated plates.

Holothuria pyxis, Selenka, 1867.

Pedicels (=papillæ ?) equally distributed all over the body, situated on conical warts. The disks of the tables more developed than in the preceding forms, with about twelve teeth or spines on the margin, arranged in groups of three, and with a peripheral circle of holes round the centre; the spire terminates in twelve teeth. The fenestrated plates like those in the preceding forms, but not collected in circles.

Habitat.—Java (Selenka).

Holothuria inornata, Semper, 1868.

Dorsal surface with papillæ; ventral surface with pedicels. Deposits entirely like those in *Holothuria pyxis*.

Habitat.—Mazatlan (Semper).

I am much inclined to consider the two latter forms as being very nearly related to one another, as well as to *Holothuria atra*, &c., though it may be observed that *Holothuria pyxis* differs from all the rest by its uniform papilla-like ambulacral appendages.

Holothuria mexicana, Ludwig, 1875.

Pedicels scattered all over the body. Deposits resembling those in *Holothuria atra*, though the fenestrated plates are more symmetrical and regularly formed.

Habitat.—Mexico (Ludwig).

(Mus. Holm.) Two specimens, one 200 mm. long, dredged at St. Bartholomew, and the other, 230 mm. long, brought home from Guadaloupe. Colour—dirty yellowish-grey, slightly darker on the back, which is marked with dark brown irregular spots. The brown pedicels are equally large and uniformly distributed. Body-wall thick, leathery. Of the crowded plates two types may be observed, one more rounded, pierced with minute and commonly more numerous holes; and the other irregularly rectangular, with fewer and larger holes. Two bundles of numerous madreporic canals (as many as twenty), with pear-shaped ends

and several long Polian vesicles. The specimen obtained at Guadaloupe differs slightly, and forms a transition to *Holothuria atra*, to which both specimens bear a great resemblance. The dorsal surface of this specimen is uniformly dark brown. The ventral surface is light yellowish-grey, with a broad longitudinal brown band along the odd ambulacrum; ventral pedicels dark brown at the base. Anus with five minute groups of papillæ. Among the dorsal slightly smaller pedicels, which, like the ventral ones, are destitute of supporting rods round the terminal plate, some appendages may be found which have a conical form and a small terminal plate surrounded by some rather strongly-formed supporting rods.

Holothuria edulis, Lesson, 1830; Semper, 1868. *Trepang edulis*, Jæger, 1833. *Holothuria fusco-cinerea*, Selenka, 1867.

Dorsal papillæ minute, and more scattered than the ventral pedicels. The disks of the tables reduced to a small ring, narrower than the top of the spire, which, seen from above, presents a small circular hole surrounded by four prominences, each with about four or five minute teeth. The fenestrated plates nearly like those in *Holothuria grisea*.

Habitat.—Philippine Islands (Semper, Lesson), Mozambique (Semper), Molucca Islands (Lesson), Amboina (Selenka, Ludwig), New Holland and Caroline Islands (Lesson), Aden (Semper), Celebes (Selenka, Ludwig), Java and Timor (Ludwig).

(Mus. Holm.) One specimen, 250 mm. long, from the Fiji Islands, and a smaller one from New Britain. Colour—dark reddish-brown on the back, light greyish on the ventral surface and the sides; a minute dark ring round the base of the light pedicels. The dorsal papillæ are very minute. A single Polian vesicle. A small bundle of about four minute, free, madreporic canals on each side of the dorsal mesentery. The base of the tables always narrower than the top. The small fenestrated plates often incomplete, resembling × -shaped spicules. The species is doubtless nearly allied to *Holothuria atra*, but seems to be well defined by the colour, the shape of the tables, &c.

4. *In addition to tables with a small annular disk, finely granulated perforated plates with the holes arranged in two longitudinal series.*

Holothuria unicolor, Selenka, 1867.

The ventral pedicels much more numerous than the dorsal. Tables like those in *Holothuria atra* and *Holothuria mexicana*. The plates are finely granulated, slightly irregularly formed, with smooth margins and numerous holes arranged in two series, each series composed of about two irregular rows.

Habitat.—Barbados (Selenka).

Semper refers this species to the group, which is characterised by papillæ on the dorsal surface. It bears the nearest resemblance to *Holothuria mexicana* or *Holothuria atra*.

E. Deposits—Tables together with Buttons.

I. Ambulacral appendages—pedicels alone; or pedicels on the ventral surface and papillæ on the dorsal, the latter being often very like the former.

1. *Buttons smooth, oval or elongate, nearly always with three pairs of holes, exceptionally with more or fewer. Spire of the tables as a rule made up of four rods and one transverse beam; exceptionally more rods and beams present.*

a. Disks of the tables smooth, without spines on the margin. Number of tentacles typical, twenty.

(1) *Ventral pedicels arranged in three more or less distinct longitudinal series.*

Holothuria monacaria (*Psolus*), Lesson, 1830; Jæger, 1833. *Holothuria flammea*, Quoy and Gaimard, 1833. *Holothuria fusco-punctata*, Quoy and Gaimard, 1833. *Holothuria fasciola*, Quoyand Gaimard, 1833. *Stichopus flammeus*, Brandt, 1835. *Stichopus gyrifer*, Selenka, 1867 and 1868. *Labidodemas leucopus*, Haacke, 1880 (according to Ludwig, 1883).

. The dorsal papillæ arranged in four indistinct longitudinal rows. The rounded disk of the tables with a central hole surrounded by from four to twelve peripheral holes. The spire terminates in about twelve teeth or more. The oval smooth symmetrical buttons with three or four pairs of holes.

Habitat.—Zanzibar (Selenka), Querimba (Semper), Mauritius (Haacke, Ludwig), Nicobar Islands, Philippine Islands, Navigator Islands, Pulo Tikul, and Amboina (Semper), Sandwich Islands (Selenka), Society Islands (Semper, Selenka, Lesson), New Ireland and Vanikoro (Quoy and Gaimard), Australia (Selenka, Semper), Waygeeoo (Ludwig), Celebes (Ludwig), Molucca Islands (Semper), Borabora (Lesson).

(Mus. Holm.) Two specimens from unknown locality, and one 110 mm. long from Pelew Islands. Professor Möbius of Kiel has also kindly sent me a small specimen, about 45 mm. long, dredged at Mauritius. In the small specimen from Mauritius, which is probably young, the pedicels are placed in three double or alternating rows on the ventral surface, an arrangement which is not so distinct in the remaining forms. Even the small dorsal papillæ do not always seem to be placed in very distinct rows. Colour of the smaller specimen—auburn, with the ventral surface, the papillæ, and a space round them paler. The large specimen from Pelew is dirty yellowish-white, speckled with brown or greenish-brown on the back. Mouth surrounded by some small papillæ. The disks of the tables are slightly undulated on the margin. The symmetrical or slightly-

asymmetrical buttons have very often more than six holes, though this number is the most common. The papillæ have a very rudimentary terminal plate, and curved, rod-like, perforated deposits. Besides, both pedicels and papillæ contain numerous crowded buttons and tables, and near the end bilateral perforated plates.

Holothuria decorata, von Marenzeller, 1881. *Labidodemas neglectum*, Haacke, 1880 (according to Ludwig, 1883).

Habitat.—Japan (von Marenzeller, Ludwig), Mauritius (Haacke, Ludwig).

According to Ludwig, this is probably the young of the former, and, indeed, there do not seem to be any distinguishing characters of sufficient importance to justify its reception as a new species. Some of the tables have as many as three transverse beams in the spire, and the buttons have generally eight holes.

Holothuria macleari, Bell, 1884.

Habitat.—Clairmont and Bird Islands in North-East Australia (Bell), Island of Rodriguez (Bell).

Bell says: "As will be seen from the figures, the spicules of this species present a considerable resemblance to those of *Holothuria tigris*, with which, as it would seem, it must be closely allied." The pedicels, however, form three longitudinal rows, the dorsal surface has papillæ, and, finally, the figured deposits seem to bear as great a resemblance to those of *Holothuria monacaria* as to those of any other form. A re-examination is necessary.

(2) *Ventral pedicels not arranged in longitudinal series.*

Holothuria humilis, Selenka, 1867.

Ambulacral appendages—pedicels. The tables with not very large disks, and with the spire terminating in eight teeth. Buttons very flat, of usual shape. All the pedicels with supporting rods, but the ventral alone possessing terminal plates. Calcareous ring very small and of uncommon shape, its ten pieces being very small, round, and brown.

Habitat.—Sandwich Islands (Selenka).

Distinguishable from the following species mainly by the peculiar calcareous ring which is unlike that of any other Holothurian.

Holothuria vagabunda, Selenka, 1867; Semper, 1868. *Stichopus* (subgenus *Gymnochirota*) *leucospilota*, Brandt, 1835 (according to Ludwig, 1881).

Ambulacral appendages—pedicels. The tables with not very large disk and with the spire terminating in eight to ten teeth, placed round the nearly circular aperture

in its top. Buttons of the usual shape with six holes. The dorsal pedicels alone have supporting rods which are spinous and tapered towards the ends.

Habitat.—Sandwich Islands and Society Islands (Selenka), Philippine Islands, MacKean's Islands, Sunda Islands, Mozambique and Aden (Semper), Zanzibar (Selenka), Java (Selenka, Ludwig), Navigator Islands (Semper, Ludwig), Nicobar Islands and Hong Kong (Ludwig), Darros Island (Bell), Ualan (Brandt), Bowen (Ludwig).

(Mus. Holm.) Two specimens from Navigator Islands, one from Port Dennor and one from Peru. Moreover, the Godeffroy Museum has specimens from the following localities: Tahiti, Massua, Eooa, Fiji Islands, Rockhampton, and New Britain. In all these specimens the ambulacral appendages appear to be of nearly equal size on the dorsal and ventral surfaces; but, at the same time, I always found the ventral ones cylindrical, and the dorsal, on the contrary, more papilliform. The ventral have a well-developed terminal plate and bilaterally symmetrical, perforated supporting plates; the dorsal have a rudimentary terminal plate and numerous simple spinous or slightly branched or even perforated rods. Besides, the ventral appendages are always more numerous than the dorsal. Thus the forms examined by me apparently present examples of dorsal appendages forming a transition between pedicels and true papillæ, and show that it is rather difficult to draw a line of demarcation between them. That the forms I have seen really belong to this species is proved by the whole internal and external organisation. The colour varies from dark brown to light reddish-brown. A single Polian vesicle and madreporic canal are present. The genital tubes are slender, and slightly dichotomously branched. The strongly-developed Cuvierian tubes are of a violet or reddish-colour. The disks of the tables are sometimes not very well developed, sometimes round or angular, with a large central hole, and several peripheral ones, and their margin is often uneven.

Holothuria lagæna, Haacke, 1880; Ludwig, 1883.

Habitat.—Mauritius (Haacke, Ludwig), Mozambique (Bell).

(Mus. Holm.) One specimen from Mauritius presented by Professor Möbius. From the description of Ludwig as well as from my own researches, I cannot find any other character distinguishing this form from the true *Holothuria vagabunda*, than the fact that it has "papillæ" instead of pedicels on the back; but even in the later species the dorsal appendages present a great resemblance to "papillæ," and I am therefore much inclined to annul this species. A re-examination and comparison of both forms will therefore be necessary.

Holothuria difficilis, Semper, 1868. *Mülleria parvula*, Haacke, 1880 (according to Ludwig, 1883).

The dorsal papillæ very thinly scattered. Ventral surface with pedicels. The disks of the tables well developed, with numerous peripheral holes, and the spire

terminating in four groups of teeth, each group composed of several (five to seven) teeth. Buttons large, of normal shape, slightly asymmetrical.

Habitat.—Navigator Islands (Semper), Mauritius (Haacke, Ludwig).

Differs from *Holothuria vagabunda* mainly in the shape of the tables.

Holothuria strigosa, Selenka, 1867.

Pedicels all over the body. Tables like those of *Holothuria vagabunda*. Buttons of two kinds—in the dorsal perisome symmetrical smaller ones like those in the above mentioned species; in the ventral, on the contrary, more elongate, robust, irregular ones, with as many as twelve minute holes. In the neighbourhood of the pedicels much larger buttons may be found.

Habitat.—Zanzibar (Selenka), Red Sea (Ludwig).

Holothuria farcimen, Selenka, 1867.

Ventral surface with numerous pedicels; dorsal surface with thinly scattered papillæ. The solid tables bear four groups of five teeth each on their top. Buttons mostly with five pairs of holes.

Habitat.—Azores Islands (Selenka).

The species seems to bear the nearest resemblance to *Holothuria difficilis*.

Holothuria captiva, Ludwig, 1875.

Ventral surface with numerous pedicels; dorsal surface with thinly scattered papillæ. Disks of the tables well developed, and spire terminating in a great number of teeth. Buttons of common shape, though slightly asymmetrical.

Habitat.—Barbados (Ludwig).

Differs from *Holothuria difficilis* by possessing a smaller calcareous ring and by the great number of teeth on the rounded top of the spire.

(Mus. Holm.) Numerous specimens from Bartholomew. The deposits are comparatively large. There are twenty or more teeth on the rounded top of the spire, but there are tables with even fewer teeth, in which case the top of the spire is truncated, not rounded. The buttons are large, elongate, fusiform, more or less obviously curved; the regularly formed ones have six holes, but I have seen buttons with even more holes, or with only two, three, or four. Sometimes buttons devoid of holes may be found. As a rule, they are thickest along the middle line. The pedicels have perforated plates round the well-developed terminal plate; the papillæ have also such plates, as well as strong curved rods. Numerous Cuvierian tubes are present. Colour in alcohol, light brown.

Holothuria curiosa, Ludwig, 1875.

Ventral surface with pedicels; dorsal surface with papillæ. Tables of varying size; in the larger the disk supports a rudimentary spire composed of four short

rods and one transverse beam, the four rods not being combined—as is usual —at the top, but terminating each in a simple point; the smaller tables have the spire reduced to one or two spines. Buttons oval, commonly less developed, and only pierced with two elongate openings.

Habitat.—Bowen (Ludwig).

(Mus. Holm.) One specimen from the Fiji Islands. Length, 180 mm. Colour in alcohol, light dirty greenish inclining to brownish or yellowish; the base of the pedicels and papillæ surrounded by a dark brown ring; tentacles yellowish. Anus with five groups of papillæ. The ventral pedicels of about the same size as the papillæ, and only a little more closely placed. A single Polian vesicle and madreporic canal. Calcareous ring agreeing with the figure given by Ludwig. Cuvierian organs strongly developed. The usually very incomplete tables consist of a small irregular disk pierced with a few holes, and supporting a spire reduced to a single spine. In the pedicels and papillæ the tables are more highly developed, having larger disks and a long spire built up of four rods and from one to five transverse beams; these spires terminate in four simple points. Ludwig does not mention anything about the presence of such tables; they possibly escaped his attention, otherwise the form examined by me is a new species, which, considering the very obvious resemblance, does not seem probable. The buttons are small and undeveloped in the body-wall itself, but in the ambulacral appendages they become larger, with six or more holes. The pedicels and papillæ have numerous elongate rods, either perforated only at each end and in the middle, or having a series of holes along each side; moreover, the pedicels have bilaterally symmetrical perforated plates round the large terminal plate. The papillæ have a very rudimentary terminal plate. Another specimen, belonging to the Godeffroy Museum, agrees in all respects with the above description, except in the circumstance that the spire of the tables never attains such a great length in the pedicels and papillæ; however, I often found these spires with two transverse beams.

Holothuria fusco-cinerea, Jæger, 1833; Semper, 1868.

Habitat.—Philippine Islands (Semper), Navigator Islands (Semper), Celebes (Jæger), Japan (Ludwig).

A comparison of the description given by Semper with that of the preceding species will show that the two forms scarcely seem to be distinguishable from each other. Even Semper points out that the tables and buttons are much more developed in the ambulacral appendages. I examined one specimen, 220 mm. long, dredged at the Navigator Islands, and preserved in the Zoological State Museum at Stockholm, which agrees in all respects with the specimen brought home from the Fiji Islands, and referred to *Holothuria curiosa*. With regard to the colour, it differs slightly in the absence of the dark rings round the base of the

ambulacral appendages, and by having some darker transverse bands on the back. Even here the deposits of the pedicels and papillæ are considerably more developed than in the body-wall itself, though the tables never seem to attain the unusual length of the spire, nor to have the great number of transverse beams.

Holothuria arenicola, Semper, 1868. *Holothuria maculata* (*Sporadipus*, subgenus *Acolpos*), Brandt, 1835 ; Ludwig, 1881.

Pedicels all over the body. The tables have the smooth disk pierced by a larger central hole and several small peripheral ones; their spire is built up of four rods and one transverse beam, and terminates in several teeth. The oval buttons regularly with six holes.

Habitat.—Philippine Islands, Amboina, Fiji Islands, and Surinam (Semper), Boninsima (Brandt), Mauritius (Haacke, Ludwig).

(Mus. Holm.) One specimen brought home from the Navigator Islands. Length, 100 mm. Colour—light yellowish-grey, with a row of distant darkish-brown spots along each dorsal ambulacrum; also some minute scattered spots. Anus surrounded by five groups of small papillæ. Tentacles very minute. Calcareous ring of the usual shape. Two Polian vesicles and a bundle of three small madreporic canals on the right side of the dorsal mesentery. The tables greatly resemble those in *Holothuria impatiens*, but they have not the nine nearly equal holes in the disk, which on the contrary is perforated by a large central hole and a varying number of small peripheral holes. The spire terminates in twenty or more teeth. The buttons are very symmetrical, as a rule with six holes. Considering that the ambulacral appendages, which have a well-developed terminal plate, are quite retracted within the body-wall, it is uncertain whether they really are pedicels. The supporting rods of these pedicels are smooth, slightly enlarged, and perforated at the middle and the ends. The species is probably very nearly related to the preceding one, and distinguishable from it only by the shape of the buttons.

β. Disks of the tables spinous on the margin and more or less developed. Number of tentacles typical, twenty.

Holothuria signata, Ludwig, 1875.

Dorsal surface with scattered papillæ; ventral surface with pedicels arranged in three longitudinal series. Tables with rudimentary spinous disk and the top of the narrow spire rounded, devoid of spines. The oval buttons with two to four holes, two considerably larger; several developmental stages of the buttons not rare.

Habitat.—Tahiti (Ludwig).

The tables bear the closest resemblance to those of *Holothuria surinamensis*, *Holothuria flavo-maculata*, and *Holothuria fusco-coerulea*. Hence, I am almost convinced that even here the spinous end of the tables is turned upwards in the living animal; and if so, the species cannot, of course, be placed in this group.

Holothuria poli, Delle Chiaje, 1823, 1841; Selenka, 1867; von Marenzeller, 1874. *Holothuria tubulosa*, Blainville, 1834. *Holothuria tubulosa*, var. *poli*, Lamarck, 1840. *Sporadipus stellati*, Grube, 1840. *Holothuria stellati*, Sars, 1857. *Holothuria glabra*, Semper, 1868.

Habitat.—Mediterranean Sea (Grube, Sars, Selenka, von Marenzeller, Ludwig, Græffe), Canary Islands (Ludwig), west coast of France (Barrois).

In spite of the very valuable contributions to the knowledge of the Mediterranean Holothurians, by Sars, Ludwig, and, above all, by von Marenzeller, several forms seem to be incompletely described, and among these is the species in question. I have not succeeded in accurately understanding the shape of the tables, the size of the dorsal ambulacral appendages, &c. In the Zoological State Museum at Stockholm are several forms, dredged at Naples, Salerno or Amalfi, Cagliari, and finally "two types" from Lesina and Pola, kindly placed at my disposal by von Marenzeller. The largest specimen was obtained at Naples, and has a length of 175 mm. Its colour is blackish-brown inclining to violet, with the ends of the dorsal and ventral ambulacral appendages whitish. The ventral appendages, considerably more crowded than the dorsal, are true cylindrical pedicels with a large sucking-disk and a well developed terminal plate surrounded by irregularly perforated rods and bilateral, elongate perforated plates. The dorsal appendages appear to be of two kinds; true pedicels resembling the ventral but smaller; and more scattered conical papillæ seemingly situated on the top of low elevations. These papillæ have a very rudimentary terminal plate and numerous curved rods. The tables are comparatively rare and undeveloped, consisting of a small spinous or angular disk, and a small generally incomplete spire. The buttons are much crowded, thick and nearly smooth orwith slightly uneven surfaces, but are never provided with spines or knobs; they vary greatly, some being small, nearly circular, with but four holes, others being more or less elongate, with as many as eight or ten holes. Sometimes the buttons are even entirely devoid of holes. A single Polian vesicle and madreporic canal are present. The numerous small specimens dredged at Cagliari differ from the above description by their brown colour as well as by the buttons being more irregularly formed, and not unfrequently furnished with some low knobs, so that they may possibly be referable to another species.

Holothuria sanctori, Delle Chiaje, 1823 and 1841; Grube, 1840. *Holothuria tubulosa*, var. *sanctori*, Lamarck, 1840.

Habitat.—Mediterranean Sea (Delle Chiaje, Grube, Ludwig).

Von Marenzeller kindly placed in my hands an example of this species dredged at Naples. Length in contracted state, 45 mm. Colour dark brown, slightly lighter on the ventral surface, and with four more or less irregular rows of light brown or yellowish spots along the dorsal surface. The five ambulacra are indicated by low ridges. The ventral pedicels are not very closely placed, have distinct sucking-disks, and well-developed terminal plates surrounded by bilaterally symmetrical, elongate, perforated plates, or even by irregularly perforated rods. So far as I can see, the dorsal appendages are of two kinds—pedicels smaller than the ventral, with well-marked sucking-disks and terminal plates surrounded by slightly curved rods mostly with none or a few holes; and small conical papillæ, running out apparently from low warts in four rows corresponding to the four yellowish spaces. These papillæ have a very rudimentary terminal plate and numerous strongly curved, smooth or slightly spinous rods having the ends slightly enlarged and perforated. The buttons are of an oval or elongated form, smooth and provided with six to twelve or sometimes fewer holes; it is not very rare to find buttons which are more or less deformed, sometimes presenting themselves as perforated, elongate, hollow or compact ellipses. The tables are well developed, having the large rounded disk mostly spinous on the margin, and perforated by a large central hole and a circle of peripheral ones. The spires are composed of four rods and one transverse beam, and their annular top bears as many as twelve teeth.

Holothuria pardalis, Selenka, 1867.

Pedicels all over the body. Tables with a spinous disk and having the spire terminating in eight to ten teeth. Buttons more or less regularly formed, of the usual shape, but accumulated in circles or rings.

Habitat.—Sandwich Islands and Zanzibar (Selenka), Navigator Islands and Port Mackay (Semper), Mozambique (Semper), Red Sea (Semper, Ludwig), Nangkauri (Ludwig), Glorioso Islands (Bell).

(Mus. Holm.) One specimen from Nangkauri, presented by Professor Möbius. Length 110 mm. Colour in alcohol, light dirty brown. The tables have often their spinous disks small and annular and the spire slightly reduced. The buttons, collected in groups or circles, are often very asymmetrical, generally pierced with six or more holes; sometimes only one side of them is developed, and they not unfrequently bear some indistinct elevations. The dorsal appendages are supported by slightly curved almost smooth rods, with the ends slightly enlarged and perforated, and their terminal plates are small. The ventral pedicels have a large terminal plate and bilaterally symmetrical, perforated rod-like plates.

Another specimen, which is preserved in the State Museum at Stockholm, evidently belongs to this species. It is of a light greyish-brown colour, with a row of about ten dark spots along each dorsal ambulacrum. The dorsal ambulacral appendages have a slightly conical form. The spire of the tables is more or less reduced. The buttons are robust and collected in larger and smaller circles. A third specimen from Eooa, belonging to the Godeffroy Museum, bears a great resemblance to the former, though the dorsal spots are not very distinct, and the circles of irregular buttons give to the surface of the skin a granulated aspect. Even here the small scattered dorsal appendages resemble papillæ.

Holothuria subditiva, Selenka, 1867.

Habitat.—Panama (Florida ?) (Selenka), Surinam (Semper).

Closely allied to the preceding species, and distinguishable from it mainly by the buttons not being collected into groups or circles. It possesses the two rows of dark spots along the back.

Holothuria lineata, Ludwig, 1875. *Labidodemas punctulatum*, Haacke, 1880 (according to Ludwig, 1883).

Habitat.—Bowen and Red Sea (Ludwig), Mauritius (Ludwig, Haacke), Thursday Island (Bell).

According to Ludwig, this species is nearly related to *Holothuria pardalis*, and, for my own part, I find it almost impossible to distinguish them from each other. In the Zoological State Museum at Stockholm I examined two specimens, one from Wallis Island and one from Rockhampton, the former differing from the typical *Holothuria pardalis* only in the circumstance that the rather asymmetrical buttons are scattered, the latter agreeing more with it in having the buttons collected into masses but not into distinct rings or circlets. Colour—dirty yellowish-grey, speckled with brownish, paler along the ambulacra, the three ventral of which are marked out by a fine darker line. Anus with a crown of small papillæ. Buttons asymmetrical and mostly incomplete. The tables have not so large a disk, as indicated by the figures of Ludwig, and the spines on the margin seem to be fewer, often eight, and larger; the spire is seldom complete, and is then very short with about eight teeth. Tentacles and calcareous ring uncommonly small. What is the difference between this species and *Holothuria subditiva ?*

Holothuria peregrina, Ludwig, 1875.

Habitat.—Bowen and Upola at Navigator Islands (Ludwig), Thursday Island (Bell).

Like the two preceding species. A re-examination is necessary.

Holothuria insignis, Ludwig, 1875.

Habitat.—Bowen, Hong Kong, and Red Sea (Ludwig).

Even this form resembles the three preceding very strikingly, and probably they are all varieties of the same species, and nearly related to *Holothuria pardalis.*

Holothuria inhabilis, Selenka, 1867.

Pedicels all over the body. The solid tables have twelve spines on the margin of the disk. The very numerous buttons are of a more unusual shape, symmetrical, swollen, with two rows of "minute" holes, about four holes in each row; the surfaces of the buttons are uneven owing to the presence of flattened elevations (no knobs), and their margin is deeply undulated.

Habitat.—Sandwich Islands and Society Islands (Selenka).

Holothuria rugosa, Ludwig, 1875.

Ventral surface with numerous pedicels; dorsal surface with scattered papillæ. The tables consist of a large spinous disk and a long conical spire which is usually composed of six rods, and carries four to six long and strong teeth on the top. The buttons have six to seven pairs of holes.

Habitat.—Navigator Islands and Waygeeoo (Ludwig).

(Mus. Holm.) One specimen, 160 mm. long, from Pelew Islands, and two from New Britain. Colour, yellowish-white. The tables have the characteristic form mentioned by Ludwig, but the conical spire seems mostly to be composed of only four rods, though I found tables with even six rods and with more teeth. The buttons are fewer in number than the closely placed tables, and among those with numerous holes I even found buttons with only six holes. Papillæ and pedicels supported by transformed tables and numerous bilaterally symmetrical, perforated plates; the former with very rudimentary terminal plates, the latter with well-developed ones.

γ. Disks of the tables spinous or smooth on the margin. Number of tentacles from twenty-five to thirty.

Holothuria discrepans, Semper, 1868.

Ventral surface with numerous pedicels; dorsal surface with thinly scattered papillæ. The rounded disk of the tables with undulated smooth margin, seldom provided with a few spines, and having commonly some of the peripheral holes confluent with the central one. Spire terminating in several teeth (about twelve). Buttons of more symmetrical and usual shape, with about six holes, present only near the pedicels. Tentacles thirty.

Habitat.—Navigator Islands (Semper).

(Mus. Holm.) One specimen from the Navigator Islands. The ambulacral appendages being retracted, it is very difficult to distinguish the difference between the pedicels and papillæ; possibly the latter have a smaller terminal plate and more numerous rod-like supporting rods. The buttons are sometimes furnished with eight holes instead of six.

Holothuria immobilis, Semper, 1868. *Holothuria collaris*, Haacke, 1880 (according to Ludwig).

Ventral surface with pedicels; dorsal surface with papillæ. The disks of the tables spinous. The buttons irregularly formed, with about six holes. Tentacles twenty-eight to thirty.

Habitat.—Philippine Islands (Semper), Mauritius (Haacke, Ludwig).

According to Semper, the deposits resemble those of *Holothuria pardalis*, consequently the spire of the tables terminates in eight to ten teeth.

(Mus. Holm.) One specimen dredged at the Navigator Islands. Length, 155 mm. Colour—ventral surface dirty yellowish-white, especially anteriorly, inclining to brown; dorsal surface brown with darker spots or bands; papillæ and tentacles almost white. Tentacles twenty-six. Anus with some papillæ. The spire of the tables is short but well-developed, and its annular top carries eight to ten or more teeth. The disks bear distinct spines round the margin, and are perforated with a larger central almost quadrangular hole and several smaller peripheral ones. The buttons are more or less asymmetrical, typically with six holes, but often with fewer. The papillæ are provided with a rudimentary terminal plate and with curved rods which are generally enlarged and perforated at the ends. The pedicels have a well-developed terminal plate, a few rods and perforated bilateral plates. Two very long Polian vesicles. A bundle of about ten small madreporic canals present on the right side of the dorsal mesentery, and only two such canals placed on the left side.

Holothuria cæsarea, Ludwig, 1875.

Pedicels all over the body excepting towards the extremities, where papillæ are substituted for pedicels. Deposits like those in the preceding species. Tentacles thirty.

Habitat.—Navigator Islands (Ludwig).

Further investigations will doubtless prove that there exists no specific distinction between the three forms above mentioned, but that they represent the same species, which, however, may be capable of variation in several respects.

Holothuria samoana, Ludwig, 1875.

Dorsal surface with papillæ; ventral surface with pedicels. The disks of the tables are rounded and smooth. The long conical spire is built up of four slightly spinous rods, and three to four transverse beams; it terminates in four teeth. The rather large buttons are not very symmetrical, and are pierced with about fourteen holes. Tentacles twenty-five.

Habitat.—Navigator Islands (Ludwig).

2. *Buttons never smooth, but rough or uneven, owing to scattered or more densely crowded, minute, or rather large elevations, knobs or spines. In complete state they have two rows of holes.*

Holothuria sulcata, Ludwig, 1875.

Pedicels all over the body. Disks of the tables small, nearly annular, spinous on the margin; the short spire terminates in about twelve teeth. The buttons are mostly incomplete, of unequal size, and irregularly knobbed. On the ventral perisome the openings on the buttons are not unfrequently closed so that they resemble oval knobbed disks.

Habitat.—West Indies (Ludwig).

Holothuria occidentalis, Ludwig, 1875.

Pedicels all over the body. The small but solid tables have the disks reduced and spinous, and the short spire terminating in four groups of three teeth each. The oval or oblong buttons have four to ten holes and numerous small knobs; they are often incomplete.

Habitat.—West Indies (Ludwig).

Several characters mentioned by Ludwig in his diagnosis seem to confirm the near relation of this form to the preceding. Ludwig has had at his disposal only one specimen of each, so that a re-examination may be useful.

Holothuria notabilis, Ludwig, 1875.

Pedicels all over the body. The tables in the ventral perisome have an irregular disk with spines on the margin, and a spire reduced to four spines; on the dorsal surface the disks are larger and the spire more highly developed. The small oval buttons have six holes and several knobs.

Habitat.—Bowen (Ludwig).

Holothuria helleri, von Marenzeller, 1877. *Holothuria affinis*, Heller, 1868.

Dorsal surface with papillæ situated on low warts; ventral surface with pedicels mostly placed along the ambulacra. The disks of the tables are round,

constantly with eight peripheral holes, and supporting a long slender spire of four rods, and usually three transverse beams; top of the spire carrying teeth. The knobbed buttons, which have three to four holes, do not always seem to be present.

Habitat.—Mediterranean Sea (von Marenzeller, Heller, Græffe, Ludwig).

(Mus. Holm.) Three specimens from Lesina, kindly presented by von Marenzeller. The dorsal appendages present a great resemblance to true pedicels. The ventral pedicels form three irregular longitudinal series. In the specimens at my disposal I found, among the more typically formed tables, others which have a much larger and irregularly shaped disk, pierced with more holes and provided with a longer spire. Two of the individuals have scattered, complete or incomplete buttons, while the third is more richly provided with buttons, pierced with six or more holes, and bearing several irregularly placed knobs.

Holothuria tubulosa, Gmelin, 1788; Tiedemann, 1816; Sars, 1857; Selenka, 1867; Marenzeller, 1874. *Mentula marina*, Plancus, 1760. Die *Zitterblase*, Bohadsch, 1776. *Fistularia tubulosa*, Lamarck, 1816. *Holothuria columnæ*, Delle Chiaje, 1823. *Holothuria maxima*, Delle Chiaje, 1823. *Holothuria pentagnæ*, Delle Chiaje, 1823.

Dorsal surface with large papillæ; ventral surface with pedicels. The small and scattered tables have the disks spinous on the margin, and the short spire terminating in about twelve teeth. The ventral perisome contains numerous thick swollen elliptic buttons, densely covered with spines, and mostly devoid of holes, but not unfrequently with from two to fourteen very minute ones; there are also to be found buttons which are more sparingly provided with spines, or rather knobs, and smaller rounded bodies with uneven surfaces and two openings. In the dorsal perisome the buttons are densely knobbed and provided with larger holes.

Habitat.—Mediterranean Sea (Grube, Heller, Græffe, Sars, von Marenzeller, Selenka, Ludwig, &c.), south-west coast of France (Fischer), Portinho (Greeff), Canary Islands (Greeff).

(Mus. Holm.) Several specimens from Naples, Salerno, Bay of Muggio, and Lesina. The species is easily known by its deposits. A part of the dorsal papillæ run out from rather prominent wart-like elevations; this, however, is not equally distinct in all specimens. The supporting plates of the pedicels are never smooth, as is the case in the following species.

Holothuria stellati, Delle Chiaje, 1823; Semper, 1868; von Marenzeller, 1874. *Sporadipus glaber*, Grube, 1840. *Holothuria tubulosa*, var. *stellati*, Lamarck, 1840. *Sporadipus stellati*, Delle Chiaje, 1841. *Holothuria glabra*, Grube, 1864.

Dorsal surface with small papillæ; ventral surface with pedicels. Deposits like those of the preceding species, excepting that the spinous elliptical buttons are absent.

Habitat.—Mediterranean Sea (Grube, Heller, von Marenzeller, Græffe, Ludwig, &c.).

(Mus. Holm.) Three specimens from Lesina, presented by von Marenzeller. All the ambulacral appendages being withdrawn into the body-wall, it is almost impossible to determine their true appearance. They seem to be of nearly equal size, and to be equally distributed all over the body. A closer microscopical examination reveals the fact that the ventral are more like pedicels in having a larger terminal plate, bilateral perforated rod-like nearly smooth plates, and strong rods with obtuse spines round the margin; some small holes occur in the slightly enlarged ends of the rods. In the dorsal papillæ the rods are smoother and the terminal plates rudimentary. As in *Holothuria poli*, the tables are more rare and their disk is reduced to a spinous ring; the spire terminates in about twelve teeth. The buttons have the same aspect as those in the species just mentioned—namely, rounded or oval, with none, two, four, six, or even more holes—but they are always densely covered with minute conical elevations, consequently their surfaces are very rough. The dorsal buttons are commonly larger, with more distinct holes.

Holothuria mammata, Grube, 1840; Ludwig, 1879. *Holothuria tubulosa*, Semper, 1868 (*partim*).

The dorsal papillæ often placed on hemispherical warts, forming five or six irregular rows. The ventral pedicels not very crowded, fewest at the middle of the ventral surface.

Habitat.—Mediterranean Sea (Grube, Ludwig).

(Mus. Holm.) Four specimens from Salerno or Amalfi, agreeing in all respects with the description of Ludwig. In the spaces between the large characteristic hemispherical warts, small ambulacral appendages may be found. The deposits seem to be in an advanced state of solution, but bear a certain resemblance to those of *Holothuria tubulosa* or *Holothuria stellati*, with which species this form must be closely allied. The tables are rather incomplete, with a simple annular disk and a spire made up of four rods and one transverse beam. The dorsal papillæ have a rudimentary terminal plate and numerous curved rods with some spines or perforations. The ventral pedicels have a well-developed terminal plate surrounded by bilateral perforated elongate plates and irregularly perforated rods.

Holothuria pleuripus (*Cystipus*), Haacke, 1880; Ludwig, 1883.

Habitat.—Mauritius (Haacke, Ludwig).

According to Ludwig, this species resembles the following one in habit as well as in the shape of the ventral deposits; in the dorsal perisome, on the contrary, the long buttons are altogether covered with knobs, and the tables are very remarkable in having the disks almost completely reduced and the spire transformed, the tables themselves acquiring a spherical aspect. In the Zoological

State Museum at Stockholm one of the original specimens which was brought home from Mauritius is preserved. Length, 50 mm. Colour—light greyish, here and there inclining to brownish. Body depressed, with a kind of brim at the area of transition between the dorsal and ventral surfaces. An alternating double row of small warts or papillæ is to be found on the brim along each side of the body; the dorsal surface bears similar scattered warts and numerous very minute papillæ. The arrangement of the minute ventral pedicels in three longitudinal series is not very distinct. Tentacles minute. The ventral buttons are provided with three to seven pairs of holes, and usually with numerous distinct knobs on the margin as well as on the middle beam; but, as a rule, the longer buttons have not their knobs so well marked. The ventral tables consist of a rounded, slightly convex disk, pierced with a larger central hole and several small peripheral ones, but their spire is low, often very irregular, sometimes built up of four rods and one transverse beam, and provided with several or numerous small teeth on the top; sometimes the spire seems to be composed of more than four rods, thus almost resembling hemispheres, a result of the presence of secondary rods uniting the margin of the disk with the top of the spire, whereby the peripheral holes in the disk become placed inside these secondary oblique rods. Thus, the ventral deposits here described do not fully agree with those in *Holothuria bowensis*, as pointed out by Ludwig. All the buttons seem to be more or less uneven from the presence of knobs. The dorsal buttons bear very distinctly-marked knobs, and the tables of the same surface are considerably larger, resembling perforated spheres or hemispheres. In the dorsal papillæ the tables are often of a more regular and delicate construction, consisting of a small annular disk and a slender conical spire, built up of four rods and two to three transverse beams, the top itself terminating in a few small teeth. The pedicels and papillæ are supported by numerous crowded rods, slightly perforated at the middle and at each end; moreover, the pedicels contain oval bilaterally perforated plates and a larger terminal plate. In the Godeffroy Museum I have seen three specimens, two from the Fiji Islands and one from Tahiti, agreeing in all respects with the above description, excepting that the ventral pedicels are evidently arranged in three longitudinal series.

Holothuria rigida (*Stichopus*), Selenka, 1867; Semper, 1868.

Dorsal surface with papillæ; ventral surface with three rows of pedicels. The tables have a spire made up of "eight" rods and terminating in numerous teeth. Buttons of two kinds—oval knobbed ones with six, seldom eight, holes and a deeply undulated margin; and large rounded spinous elliptical ones mostly pierced with six to ten holes, but often quite devoid of holes.

Habitat.—Zanzibar, Society Islands, and Florida (Selenka).

From the figure given by Selenka, it seems somewhat uncertain whether the oval buttons are entirely smooth or provided with low rounded elevations.

3. *Buttons—smooth ones in company with knobbed.*

Holothuria bowensis, Ludwig, 1875.

Ventral surface with pedicels; dorsal surface with papillæ. The tables have a well developed, smooth, symmetrical disk, perforated with a central hole surrounded by a simple or double circle of peripheral ones, and a slender spire made up of four rods and four or five transverse beams; the spire is spinous not only at the top, but also in its neighbourhood. The buttons are partly smooth elongate, with three to seven pairs of holes, partly smaller oval with three pairs of holes and some knobs on the middle beam.

Habitat.—Bowen (Ludwig).

4. *Buttons either partly or altogether transformed into fenestrated hollow eggs.*

Holothuria coluber, Semper, 1868.

Dorsal surface with papillæ; ventral surface with pedicels. The tables like those in *Holothuria martensii*, thus having a long spire of four rods and three to five transverse beams. Buttons partly regularly formed, partly transformed into hollow fenestrated eggs.

Habitat.—Philippine Islands (Semper).

According to Semper, the tables are like those in *Holothuria martensii*, but, judging from the figures given by the same author, their disks are not smooth on the margin but uneven, dentate, or spinous. The meaning of "regularly formed buttons" is not clear, as it leaves undecided the smooth or knobbed character of the buttons.

Holothuria chilensis, Semper, 1868.

Pedicels all over the body. The disks of the tables have a slightly uneven margin, and the spire, built up of four rods and one transverse beam, terminates in about twelve teeth. The buttons are often transformed into hollow fenestrated eggs.

Habitat.—Chili (Semper).

Even here the description of Semper is not entirely satisfactory with regard to the buttons, whether they are smooth or not. In the explanation of the plates he speaks of "rosettes," which are not mentioned in the text.

Holothuria kubaryi, Ludwig, 1868.

Pedicels all over the body. Deposits like those in *Holothuria coluber*.

Habitat.—Pelew Islands (Ludwig).

Further investigations are required to prove whether there really exist any differences between this species and *Holothuria coluber*, which at least must be nearly allied. *Holothuria kubaryi* has a whitish colour, the spire of the tables lower and more spinous, and pedicels all over the body, while *Holothuria coluber* is blackish, and has pedicels as well as papillæ, &c.

II. Ambulacral appendages—papillæ alone.

1. *Buttons smooth.*

Holothuria princeps, Selenka, 1867.

The disk of the tables provided with twelve spines on the margin, and the spire, made up of four rods and one transverse beam, terminates in eight teeth. The buttons of delicate construction, symmetrical, and undulated on the margin. In the papillæ the tables are transformed, presenting themselves under the shape of conical slender bodies with the disk reduced to a simple ring and the spire terminating in a simple point.

Habitat.—Florida (Selenka), Egmont Key (Verrill).

The species is characterised by the radial pieces of the calcareous ring being prolonged and bifurcated posteriorly. To judge from the figure given by Selenka, the buttons must be smooth and pierced with six holes, though the author does not mention anything about that in the text.

Holothuria impatiens (*Fistularia*), Forskaal, 1775; Gmelin, 1788; Semper, 1868; Ludwig, 1875. *Trepang impatiens*, Jæger, 1833. *Thyone impatiens*, Blainville, 1834. *Sporadipus impatiens*, Grube, 1840. *Holothuria botellus*, Selenka, 1867 and 1868; Semper, 1868. *Holothuria fulva*, Quoy and Gaimard, 1833.

The smooth solid disks of the tables are, as a rule, pierced with nine nearly equally large holes in three rows, and the spire, made up of four rods and one or two transverse beams, terminates in numerous teeth. The symmetrical buttons have always six holes.

Habitat.—Mediterranean Sea (von Marenzeller, Grube, Ludwig, Semper, &c.), Red Sea (Gray, Forskaal, Ludwig, Semper), Gulf of Suez (Gray, Semper), Zanzibar (Selenka), Mauritius (Haacke, Ludwig), Mozambique (Semper, Bell), Madagascar (Ludwig), Amboina (Ludwig, Semper), Philippine Islands, Navigator Islands, Fiji Islands, Nicobar Islands, Pelew Islands, MacKean's Island and Palma (Semper), Society Islands, Sandwich Islands, Tortugas, Florida, and Panama (Selenka), Java (Semper, Kuhl and Hasselt), Timor, Banda, Cape York, Tahiti, and Surinam (Ludwig), New Holland (Quoy and Gaimard).

(Mus. Holm.) Several specimens from Friendly Islands, Navigator Islands, Mauritius, and St. Bartholomew.

(Mus. Godeffroy). Several specimens from Marquesas, Apia, Eooa, and the Fiji Islands. Papillæ numerous, equally distributed all over the body, and situated on rounded warts. Colour in alcohol, lighter or darker brownish inclining to violet. Integument rough. The tables have more rarely two transverse beams, and terminate in about twenty or more teeth. The buttons are crowded, smooth, symmetrical, oval, always with six holes. The papillæ are supported by a rudimentary terminal plate and numerous transverse rods, which are commonly perforated at the enlarged ends and the dilated middle. In one of the specimens examined the Cuvierian tubes are very large, the madreporic canal single, and the Polian vesicles two in number. In the specimen brought home from St. Bartholomew two transverse beams are usually present on the tables.

Holothuria gracilis, Semper, 1868.

The tables like those in the preceding species, but never with two transverse beams. The buttons mostly with larger and more numerous holes (about twelve), and of a more irregular form.

Habitat.—Philippine Islands and Pelew Islands (Semper).

The species, as Semper says, is doubtless more closely allied to the preceding one than to *Holothuria pardalis*.

Holothuria verrucosa, Selenka, 1867.

Habitat.—Sandwich Islands (Selenka), Indian Ocean (Ludwig).

The species does not seem to be well defined. The tables are very solid, with teeth on the margin of the disk. The buttons are not more minutely described. The tentacles form two concentric circles (?). The papillæ with numerous spinous or perforated plate-like rods.

2. *Buttons knobbed.*

Holothuria scabra, Jæger, 1833; Semper, 1868. *Holothuria tigris*, Selenka, 1867 and 1868.

The tables are solid, with a smooth, well-developed disk, and with the spire of the usual shape, terminating in several teeth (twelve to sixteen). The buttons are symmetrical, with six holes, and for the most part knobbed.

Habitat.—Fiji Islands, Pelew Islands, Querimba, and Philippine Islands (Semper), Mauritius (Haacke, Ludwig), Amboina, Java, Caroline Islands, and Zanzibar (Selenka), Red Sea (Ludwig, Semper), Berbera, Timor, Macassar, and Banka (Ludwig), Celebes (Jæger).

(Mus. Holm.) Several specimens dredged at Mauritius, Torres Strait, Gulf of Siam, Fiji Islands, Singapore, Java, and Port Natal. The colour is somewhat variable in the different individuals. In that from Mauritius, which has a length of 170 mm., the dorsal surface is cinereous, with almost black transverse bands corresponding to transverse furrows, and with a few small whitish bands or spots; the ventral surface is yellowish-white, and the papillæ are surrounded by a small dark circle. The specimen obtained at the Fiji Islands has the back much paler and punctated, provided with a few larger darker spots, but devoid of the blackish transverse bands. The specimens from Java and Singapore also possess such transverse bands, but in the latter the bands are whitish, with black outlines. Anus not very distinctly stellate. Mouth surrounded by a brim-like circle of papillæ. All the ambulacral appendages are papillæ, not pedicels as Selenka says; the ventral are sometimes slightly larger than the dorsal. The internal organisation agrees with that described by Selenka. The solid tables have the spire built up of four rods and one transverse beam, and terminating in sixteen to twenty-five teeth, or even more. The disks of the tables are mostly well-developed, smooth on the margin, and pierced by a larger central hole and a peripheral circle of small ones. The buttons vary slightly in shape, but are mostly oval with six holes; they are seldom or never entirely smooth, but more or less distinctly provided with knobs. I often found only two knobs placed on the middle beam, but not unfrequently knobs, or at least rounded elevations may be met with on the periphery. Here and there more delicately constructed buttons, provided with more prominent and numerous knobs, are to be observed. The papillæ are supported by a very rudimentary terminal plate, by transverse rods enlarged and perforated at the middle and at each end, and by larger and longer almost completely smooth buttons, often with more than six holes.

Holothuria aculeata, Semper, 1868.

Habitat.—Philippine Islands (Semper).

The deposits of this species seem to be scarcely distinguishable from those in the preceding one, with which it must be nearly allied. Possibly the buttons are of a more irregular shape and have the margin more obviously undulated. Semper figures six knobs on these buttons. Besides, this species is in possession of five indistinct groups of papillæ round the anus. A re-examination is necessary.

Holothuria fusco-punctata, Jæger, 1833; Semper, 1868.

The tables like those in the preceding form, excepting that the disks are reduced to a simple ring with some small irregular processes. The buttons are slightly irregular, oblong, with an undulated margin; they have numerous knobs and about twelve holes.

Habitat.—Celebes (Jæger, Semper).

The above description of the deposits is in conformity with the figures given by Semper. The species is distinguished from *Holothuria aculeata* even by the want of supporting rods in the papillæ.

Holothuria albiventer, Semper, 1868.

The tables have the large rounded disk perforated with numerous smaller holes and the margin smooth; the short spire is formed by six to ten rods (instead of four, which is the common number), and its large hemispherical top is covered with small spines or teeth. The oval symmetrical buttons have six holes and two knobs on the middle beam.

Habitat.—Philippine Islands, Amboina, and Red Sea (Semper).

(Mus. Godeffroy.) One specimen from the Pacific Ocean. Tentacles slightly unequal. Mouth ventral, surrounded by a crown of small papillæ. Five indistinct groups of small rough papillæ or papilliform elevations at the anus. Ambulacral appendages—rigid rough papillæ of obviously conical form, those on the ventral surface larger and fewer than the dorsal ones which are more crowded and more unequal in size. Colour—ventral surface dirty grey and finely punctated, with the papillæ whitish; dorsal surface dark almost blackish-brown; tentacles yellowish-brown. A single Polian vesicle and madreporic canal, the latter rather long and like an elongate vesicle. The calcareous ring has the radial pieces much more deeply furrowed anteriorly than is indicated by Semper. The disks of the tables are rather large, smooth on the margin, and perforated by numerous small holes, the central of which are of about the same size as the rest; the under surface of the disks is distinctly convex. The spire, sometimes longer, sometimes shorter, is built up of more than four, not unfrequently about ten, rods, and terminates in a rounded very spinous top; a side view of the spire often presents some minute superposing holes, indicating the presence of two or three transverse beams, which, however, are very indistinct. Among these tables I find some scattered ones with more elongated spires. The typical form of buttons is the oval one, with six holes and two distinct knobs on the middle beam, and with a series of rounded, sometimes very indistinct, sometimes, on the contrary, rather prominent elevations round the margin. Here and there other buttons may be seen of a more elongated shape and furnished with more holes and knobs. The ventral papillæ contain the following deposits—knobbed buttons like those in the body-wall itself; tables of the above mentioned kind as well as others with the spire much longer, narrower, having five to eight transverse beams and often some spines on the sides; smooth curved supporting rods with some holes at the middle and at the ends; and some elongated, bilateral, perforated plates round the rudimentary terminal plate. The dorsal papillæ seem to be devoid of such bilateral perforated plates, and have the terminal plate much more fragmentary or even absent.

Holothuria martensii, Semper, 1868.

The tables have a smooth or slightly uneven disk and a long spire composed of four rods and three to five transverse beams. The buttons commonly provided with six holes and two knobs on the middle beam.

Habitat.—Amboina (Semper), Celebes and Banda (Ludwig).

(Mus. Holm.) One specimen from Banka and another from Darnley Island. Concerning my own researches regarding these specimens, I may refer to what is said with regard to the Challenger specimens (p. 177), with which they agree in most respects. It may, however, be pointed out that the disks of the tables in the latter specimen seem to be considerably larger and more irregular, and that the spire seems to be longer; even the buttons have generally more holes and knobs, and attain a greater length.

3. *Buttons of two kinds, smooth and knobbed.*

Holothuria squamifera, Semper, 1868.

In addition to the smaller more numerous tables of the usual shape, much larger ones may be found, having the disk more richly perforated and the spire long, narrow, and provided with several transverse beams (about five). The smooth buttons have eight to twelve holes; the knobbed ones are less common and of slightly more irregular shape.

Habitat.—Philippine Islands, Navigator Islands, and Java (Semper).

The papillæ of this species are scale-like, and the mouth is surrounded by small groups of papillæ.

Holothuria cubana, Ludwig, 1875.

The tables have a knobbed disk and a short spire terminating in numerous teeth. The smooth buttons are slightly deformed, resembling oblong plates with uneven margins and a few small holes. The knobbed buttons are oval, symmetrical, commonly pierced by ten holes, and carrying numerous knobs.

Habitat.—Cuba (Ludwig).

The following forms are mostly very incompletely known and in need of re-examination :—

Holothuria ecalcarea, Sars, 1859 and 1861.

Habitat.—Finmark (Sars), White Sea (Jarzynsky).

Nearly allied to *Holothuria tremula*, and probably identical with it, the calcareous matters having probably been dissolved by some impurity in the alcohol.

Holothuria cavolini, Delle Chiaje, 1823 and 1841.

Habitat.—Mediterranean Sea (Delle Chiaje).

Sporadipus maculatus, Grube, 1840.

Habitat.—Mediterranean Sea (Grube).

Stichopus cinerascens, Grube, 1840.

Habitat.—Mediterranean Sea (Grube).

Holothuria lilla, Lesson, 1830.

Habitat.—Borabora in Society Islands (Lesson).

Holothuria subrubra, Quoy and Gaimard, 1833.

Habitat.—Mauritius (Q. and G., Hoffmann).

Holothuria maxima (*Fistularia*), Forskaal, 1775; Selenka, 1867.

Habitat.—Red Sea (Forskaal, Rüppel), Mozambique (Bell).

Holothuria obscura, Lesueur, 1824. *Actinopyga obscura*, Verrill, 1867 to 1871.

Habitat.—St. Bartholomew (Lesueur).
Compare the above description of *Holothuria lubrica*.

Holothuria aglutinata, Lesueur, 1824. *Bohadschia agglutinata*, Verrill, 1867 to 1871.

Habitat.—St. Bartholomew (Lesueur).

Holothuria nigra, Peach, 1845; Foot, 1860; Bell, 1884. *Cucumaria niger*, Kinahan, 1859.

Habitat.—British Islands (Peach, Bell, Norman, Kinahan).

Holothuria sordida (subgenus *Microthele*), Brandt, 1835; Ludwig, 1881.

Habitat.—Caroline Islands (Brandt).

Holothuria maculata, Lesueur, 1824.

Habitat.—St. Bartholomew (Lesueur).

Holothuria tigris (subgenus *Microthele*), Brandt, 1835; Ludwig, 1881.

Habitat.—Caroline Islands (Brandt).

Holothuria californica, Stimpson, 1857.

Habitat.—California (Stimpson).

Holothuria ocellata (*Bohadschia*), Jæger, 1833; Semper, 1868.

Habitat.—Celebes (Jæger).

Compare the description of a Challenger specimen referred to this species (p. 178).

Holothuria lineolata (*Bohadschia*), Jæger, 1833; Semper, 1868.

Habitat.—Celebes (Jæger).

Holothuria albiguttata (*Bohadschia*), Jæger, 1833; Semper, 1868.

Habitat.—(?)

Holothuria brunnea, Chamisso and Eysenhardt, 1820.

Habitat.—Guajan among Marianne Islands (Ch. and Eys.).

Holothuria monosticha, Haacke, 1880.

Habitat.—Seychelle Islands (Haacke).

Holothuria fasciata, Lesueur, 1824. *Bohadschia fasciata*, Verrill, 1867 to 1871.

Habitat.—St. Bartholomew (Lesueur).

Sporadipus gigas, Oersted, Verrill, 1867 to 1871.

Habitat.—Caribbean Sea.

Holothuria mollis, Hutton, 1872 and 1879.

Habitat.—New Zealand (Hutton).

Holothuria robsoni, Hutton, 1879.

Habitat.—Cape Campbell, New Zealand (Hutton).

Holothuria maculata, Kuhl and van Hasselt, 1869.

Habitat.—Anjer, Java (Kuhl and van Hasselt).

Holothuria heros, Agassiz, 1852.

Habitat.—Florida (Agassiz).

Holothuria sp., Rathbun, 1879.

Habitat.—Plataforma and Bahia (Rathbun).

Holothuria sp. (*Fistularia*), Forskaal, 1775.

Habitat.—Red Sea (?).

Holothuria sp., Anderson, 1862.

Habitat.—Shetland (Anderson).
Possibly a *Colochirus*.

Holothuria fasciata, Quoy and Gaimard, 1833.

Habitat.—Vanikoro (Q. and G.).

Holothuria lucifugus, Quoy and Gaimard, 1833. *Stichopus lucifugus*, Brandt, 1835.

Habitat.—Carteret (Q. and G.).

Holothuria ophidiana, Quoy and Gaimard, 1833.

Habitat—New Guinea (Q. and G.).

Holothuria umbrina, Rüppell, 1828.

Habitat.—Red Sea (Rüppell).

Ananus holothuroides, Sluiter, 1880.

Habitat.—Java (Sluiter).
Probably a deformed individual of *Holothuria pyxis* or some other species.

Holothuria timama, Lesson, 1830. *Psolus timama*, Jæger, 1833.

Habitat.—Offack in Waigiou (Lesson).

Holothuria forskaalii, Delle Chiaje, 1823, 1841.

Habitat.—Mediterranean Sea (Delle Chiaje).

Holothuria glaberrima, Risso, 1826.

Holothuria ovata, Risso, 1826.

Holothuria mamillata, Risso, 1826.

Holothuria littoralis, Risso, 1826.

Holothuria stellata, Risso, 1826.

Holothuria punctata, Risso, 1826.

These six forms were probably dredged in the Mediterranean Sea. Some of them are probably not Holothurids but belong to other groups of animals.

LIST OF LOCALITIES AT WHICH SPECIMENS TOO FRAGMENTARY FOR ACCURATE DIAGNOSIS WERE OBTAINED.

Station 274.—September 11, 1875; lat. 7° 25′ S., long. 152° 15′ W.; depth, 2750 fathoms; bottom temperature, 35°·1; Radiolarian ooze. A single pedate Holothurian, in such a defective state that no examination is possible. The specimen probably belongs either to the Psychropotidæ or to those forms of deep-water Aspidochirotæ which present themselves under a shape like that of some of the Psychropotidæ.

Station 244.—June 28, 1875; lat. 35° 22′ N., long. 169° 53′ E.; depth, 2900 fathoms; bottom temperature, 35°·3; red clay. One very fragmentary specimen. The almost cylindrical ambulacral appendages, probably pedicels, are minute, numerous, and especially crowded along the sides of the body; they do not present any arrangement in rows. The ventral surface seems to be devoid of pedicels. The deposits of the body-wall consist of numerous crowded tables, the delicate disks of which attain a considerable size, about 0·2 mm. in diameter, and are pierced by six large holes surrounding a small central hole; the holes are often not closed, so that the disk seems to consist of six rods radiating from the perforated centre. The spire is composed of three rather long rods and a transverse beam situated near the disk. The spire terminates in three very long teeth. The pedicels are supported by a few more or less curved, spinous rods; their terminal plates are absent, having possibly been dissolved by some impurity in the alcohol. The deposits are very like those in *Holothuria lactea*, but the species differs from the latter by possessing far more numerous pedicels, in having the supporting rods of the pedicels very spinous, &c. There is good reason for believing that the two forms in question may be referred to the same genus, but the material is inadequate to decide this point.

Station 325.—March 2, 1876; lat. 36° 44′ S., long. 46° 16′ W.; depth, 2650 fathoms; bottom temperature, 32°·7; blue mud. Some very fragmentary specimens, possibly allied to the Elasipoda.

Station 160.—March 13, 1874; lat. 42° 42′ S., long. 134° 10′ E.; depth, 2600 fathoms; bottom temperature, 33°·9; red clay. A fragmentary Holothurid with respiratory-trees, but possibly without ambulacral appendages. Body of a narrow cylindrical form. Colour white. Two Polian vesicles; and apparently two bundles of slender, slightly branched genital tubes, one on each side of the dorsal mesentery.

Station 241.—June 23, 1875; lat. 35° 41′ N., long. 157° 42′ E.; depth, 2300 fathoms; bottom temperature, 35°·1; red clay. Two very macerated specimens with the deposits dissolved.

Station 271.—September 6, 1875; lat. 0° 33′ S., long. 151° 34′ W.; depth, 2425 fathoms; bottom temperature, 35°; Globigerina ooze. Fragments of one specimen (Pl. X. fig. 10).

Station 244.—June 28, 1875; lat. 35° 22′ N., long. 169° 53′ E.; depth, 2900 fathoms; bottom temperature, 35°·3; red clay. Six specimens. The dorsal surface of the elongate, flattened body carries rather large conical warts. On the ventral surface, which is almost totally destroyed, I have observed some small cylindrical pedicels; but the arrangement of these pedicels is unknown. The integument, which is of a whitish yellow colour, is strengthened by crowded deposits (compare Pl. X. fig. 10) consisting of four slightly curved arms and a long spinous outwardly directed process, the length of which is about 0·09 mm.; the arms, which are slightly shorter, have the ends dilated and perforated. On the ventral surface these deposits seem to be slightly smaller, and sometimes I have seen the ends of some of the arms connected with one another. The deposits bear some resemblance to those found in several Elasipoda, but, to judge from the external appearance, the specimen seems to be more nearly related to the Aspidochirotæ. The tentacles and all the internal organs and a good deal of the body-wall are spoiled.

The six specimens obtained at Station 244 are much smaller, only about 90 mm. long, and they are much better preserved than the former specimen. The body is flat and surrounded by a brim, on the margin of which papillæ or processes are situated. Even the dorsal surface carries such scattered conical papillæ. These papillæ are broad at the base, as much as 5 or 6 mm. in diameter, and their tops are prolonged into a long, narrow, and slender end. So far as I can discover, the ventral surface is furnished with a simple irregular row of small pedicels along each side; these pedicels appear to belong to the lateral ventral ambulacra, while the odd ambulacrum is devoid of them. The mouth is completely ventral in position, and surrounded by nineteen tentacles resembling those in the Aspidochirotæ. The anus is dorsal. The calcareous deposits are like those above described, excepting that they are smaller and that they often have five arms instead of four. From the defective state of the specimens it is impossible to decide whether they belong to the Aspidochirotæ or are Elasipods.

Station 122.—September 10, 1873; lat. 9° 5′ S. to 9° 10′ S., long. 34° 50′ W. to 34° 53′ W.; depth, 32 to 400 fathoms; red mud. Two specimens in such a deformed state that no closer examination is possible. The animals, being in possession of pedicels and respiratory-trees, but lacking retractors, seem to belong to the Aspidochirotæ. So far as I can see, two bundles of short, simple genital tubes are present. A single Polian vesicle and a very narrow calcareous ring are to be found. The deposits of the body-wall are probably dissolved, but the skin is covered and pierced by an immense quantity of foreign materials.

Station 211.—January 28, 1875; lat. 8° 0′ N., long. 121° 42′ E.; depth, 2225 fathoms; bottom temperature, 50°·5; blue mud. A fragmentary specimen of an Elasipod. The deposits consist of four-armed spicules with the ends of the arms slightly enlarged, very spinous, and sometimes pierced by a hole. Each arm sends out one

considerable spinous process, and also sometimes some smaller processes; the central part of the deposits is rather long and rod-like, two arms diverging from each extremity.

Station 45.—May 3, 1873; lat. 38° 34′ N., long. 72° 10′ W.; depth, 1240 fathoms; bottom temperature, 37°·2; blue mud. Fragments of a pedate Holothurid.

Station 205.—November 13, 1874; lat. 16° 42′ N., long. 119° 22′ E.; depth, 1050 fathoms; bottom temperature, 37°; blue mud. Some fragments of Elasipods (?).

Station 302.—December 28, 1875; lat. 42° 43′ S., long. 82° 11′ W.; depth, 1450 fathoms; bottom temperature, 35°·6; Globigerina ooze. Fragments of one specimen.

Station 92.—July 26, 1873; lat. 17° 54′ N., long. 24° 41′ W.; depth, 1975 fathoms; Globigerina ooze. A very incomplete specimen.

Station 323.—February 28, 1876; lat. 35° 39′ S., long. 50° 47′ W.; depth, 1900 fathoms; bottom temperature, 33°·1; blue mud. Some fragments of Elasipoda doubtlessly belonging to the family Elpidiidæ.

Station 298.—November 17, 1875; lat. 34° 7′ S., long. 73° 56′ W.; depth, 2225 fathoms; bottom temperature, 35°·6; blue mud. Five very deformed and macerated specimens.

Station 152.—February 11, 1874; lat. 60° 52′ S., long. 80° 20′ E.; depth, 1260 fathoms; Diatom ooze. Three specimens almost completely destroyed, which seem to be allied to those from Station 298. It is impossible to obtain an idea of the external shape of the body, the exterior layers of the perisome, together with the processes and other ambulacral appendages having been thrown off. However, the body is probably elongate, possibly narrow, and more or less distinctly cylindrical. The number of tentacles is about twenty, but I am by no means sure of it. Two Polian vesicles seem to be present, and a bundle of short, slightly branched genital tubes is situated on each side of the dorsal mesentery. The respiratory-trees are well developed. The colour seems to be dark violet. The specimens obtained at Station 152 are larger; the anterior portion of one specimen measuring about 125 mm. in length and 18 mm. in breadth.

Station 160.—March 13, 1874; lat. 42° 42′ S., long. 134° 10′ E.; depth, 2600 fathoms; bottom temperature, 33°·9; red clay. One specimen, provided with respiratory-trees. Body elongate, fusiform, about 135 mm. long. The ambulacral appendages are present in the living animal, but they are destroyed in the Challenger individual, so that their arrangement is not distinguishable; however, one can determine that the three ventral ambulacra have been provided with ambulacral appendages, those in the odd ambulacrum being evidently pedicels and disposed in a double row. Tentacles unknown, fifteen or twenty (?). Two Polian vesicles present. A thin bundle of long genital tubes is situated on each side of the dorsal mesentery.

Station 146.—December 29, 1873; lat. 46° 46′ S., long. 45° 31′ E.; depth, 1375 fathoms; bottom temperature, 35°·6; Globigerina ooze. One fragmentary specimen belonging either to the Elasipoda or to the deep-water Aspidochirotæ. Colour pale violet. Length, 70 mm.

Station 89.—July 23, 1873; lat. 22° 18′ N., long. 22° 2′ W.; depth, 2400 fathoms; bottom temperature, 36°·6; Globigerina ooze. A single very deformed specimen. Length about 65 mm. Colour dark violet. Body probably with pedicels or rather papillæ in a row round its sides. Deposits of a peculiar shape; partly larger and smaller cruciform bodies (Pl. X. fig. 12), composed of four more or less strongly curved spinous arms and an outwardly directed central spinous process, partly more scattered, very strongly constructed, cruciform bodies with the curved arms slightly spinous and branched, and with a very long, straight, outwardly directed, central column, terminating in four hooks, like an anchor with four flukes.

Station 298.—November 17, 1875; lat. 34° 7′ N., long. 73° 56′ E.; depth, 2225 fathoms; bottom temperature, 35°·6; blue mud. One specimen.

Station 299.—December 14, 1875; lat. 33° 31′ S., long. 74° 43′ W.; depth, 2160 fathoms; bottom temperature, 35°·2; blue mud. One specimen.

The two forms, obtained from the above mentioned Stations, closely resemble *Pseudostichopus villosus*, but, in spite of the most careful examination, I cannot find any pedicels or processes, excepting some small elevations at the anus. Notwithstanding this, the radial ambulacral vessels seem to be present, and I have also observed some small lacunæ within the perisoma, which doubtless are in communication with those radial vessels. Even the elevations in the neighbourhood of the anus contain lacunæ. Here and there some very minute darker points are visible, and these possibly may form a kind of ambulacral appendage. It seems hardly credible that these two forms, which bear such an obvious resemblance to *Pseudostichopus*, especially *Pseudostichopus villosus*, can be totally in want of pedicels. That which makes the investigations of the ambulacral appendages difficult and their results very dubious, is the absence of calcareous deposits in the perisoma.

The two specimens in question are very large, from 220 to 280 mm. long, and of an oval form. Their colour is pale dirty grey, inclining to brownish. The mouth is almost terminal, though turned toward the ventral surface. The anus is almost terminal and enclosed between two vertical folds of the body-wall. The twenty tentacles seem to be discoidal and carry some small retractile processes. The body-wall is very thin, excepting along the sides of the body, where it is slightly thicker. The longitudinal muscular bands are broad and simple. The retractors are absent. The calcareous ring (Pl. X. fig. 14) is devoid of any posterior prolongations, and is notched anteriorly for the longitudinal muscles, &c. A single ventral Polian vesicle and dorsal madreporic canal are present. A bundle of short, thick, slightly branched genital tubes is situated on each side of the dorsal mesentery; the branches of these tubes terminate in oval sacciform dilatations, which in the individual examined by me contained eggs. The respiratory-trees are comparatively well-developed. It is impossible to decide whether deposits have been present in the perisoma or not, though I believe the former to be the case.

GEOGRAPHICAL TABLES.

TABLE I.—Arctic and Antarctic Oceans.

	Arctic Ocean.					Antarctic Ocean.	
	North-eastern part of North America, southwards to Maine.	Greenland, Iceland, and Jan Mayen.	Northern part of Scandinavia, north of the Arctic Circle.	Rest of N. European Continent, incl. Spitzbergen, Bear Isl., Nova Zemlia, and the N. Asiatic Coast to Behring Strait.	Behring Strait, southwards to Kurile Islands and Vancouver's Island.	Kerguelen Islands, Heard Island, Marion Island.	Strait of Magellan, Falkland Islands, and their vicinity.
Synapta inhærens, O. F. Müller,			×	×			
Chirodota studerii, Théel,						×	×
lævis, Fabricius,	×	×	×	×			
purpurea, Lesson,							×
contorta, Ludwig,						×	×
discolor, Eschscholtz,					×		
Myriotrochus rinkii, Steenstrup,	×	×	×	×			
Acanthotrochus mirabilis, Danielsen and Koren,				×			
Trochoderma elegans, Théel,				×			
Ankyroderma jeffreysii, Danielsen and Koren,			×	×			
affine, Danielsen and Koren,				×			
danielseni, n. sp.,							×
Eupyrgus scaber, Lütken,		×	×	×			
Trochostoma boreale, Sars,			×	×			
thomsonii, Danielsen and Koren,			×	×			
violaceum, Studer,						×	
turgidum, Verrill,	×						
arcticum, von Marenzeller,			×	×			
Cucumaria vicaria, Bell,							×
miniata, Brandt,					×		
populifer, Stimpson,					× ?		
calcigera, Stimpson,	×	×		×			
nigricans, Brandt,					×		
glacialis, Ljungman,				×			
lævigata, Verrill,						×	
crocea, Lesson,							×
frondosa, Gunnerus,	×	×	×	×			
vegæ, n. sp.,					×		
minuta, Fabricius,	×	×		×			
mendax, n. sp.,							×
elongata, Düben and Koren,				× ?			
kowalevskii, Jarzynsky,				×			
perspicua, Ludwig,		×					
salmini, Ludwig,							×
abyssorum, n. sp.,							×
var. *hyalina*, n.,							×

TABLE I.—*continued.*

	Arctic Ocean.					Antarctic Ocean.	
	North-eastern part of North America, southwards to Maine.	Greenland, Iceland, and Jan Mayen.	Northern part of Scandinavia, north of the Arctic Circle.	Rest of N. European Continent, incl. Spitzbergen, Bear Is., Nova Zemlia, and the N. Asiatic Coast to Behring Strait.	Behring Strait, southwards to Kurile Islands and Vancouver's Island.	Kerguelen Islands, Heard Island, Marion Island.	Strait of Magellan, Falkland Islands, and their vicinity.
Cucumaria kerguelensis, n. sp.,						×	
serrata, n. sp.,						×	
var. *intermedia*, n.,						×	
var *marionensis*, n.,						×	
Echinocucumis typica, Sars,			×	×			
Thyone spectabilis, Ludwig,							×
fusus, O. F. Müller,			× *s*				
meridionalis, Bell,							×
muricata, Studer,						×	
cigaro, Troschel,	×						
recurvata, n. sp.,						×	
lechleri, Lampert,							×
Stereoderma unisemita, Ayres,	×						
Thyonidium drummondii, Thompson,			× *s*				
productum, Ayres,	× *s*						
pellucidum, Fleming,			×	×			
Orcula barthii, Troschel,	×	×		×			
luminosa, Lampert,		×					
Psolus regalis, Verrill,	×						
phantapus, Strussenfeldt,	×	×	×	×			
fabricii, Düben and Koren,	×	×		×	×		
squamatus, Düben and Koren,	×		×				
ephippifer, Wyville Thomson,						×	
antarcticus, Philippi,							×
poriferus, Studer,						×	
disciformis, n. sp.,							×
incertus, n. sp.,						×	
operculatus, Pourtalès,	× *s*						
Stichopus sitchaensis, Brandt,					×		
challengeri, n. sp.,						×	
Pseudostichopus mollis, n. sp.,						×	
villosus, n. sp.,							×
var. *violaceus*, n.,							×
Holothuria intestinalis, Ascanius and Rathke,			×	×			
magellani, Ludwig,							×
thomsoni, var. *hyalina*, n.,							×
ecalcarea, Sars,			×	×			
tremula, Gunner,			× ?	× ?			

TABLE II.—Atlantic Ocean.

	Scandinavia, south of the Arctic Circle.	British Islands and France.	Spain, Portugal, Azores Islands.	Mediterranean Sea.	East Coast of North America, from Maine to Florida, including Bermudas.	West Indies, incl. Florida, G. of Mexico, East Coast of Central America and South America, as far as the River Amazon.	West Coast of Africa, including Madeira, Canary Islands, &c.	East Coast of South America.
Rhabdomolgus ruber, Keferstein,		×						
Synapta lappa, J. Müller,						×	×	
polii, Ludwig,						×		
inhærens, O. F. Müller,	×	×		×	×		×	
gracilis, Selenka,					×			
roseola, Verrill,					×			
pourtalesii, Selenka,						×		
digitata, Montagu,		×	×	×			×	
benedeni, Ludwig,								×
tenera, Norman,	×	×						
hispida, Heller,				×				
vivipara, Œrsted,						×		
picta, n. sp.,					×			
abyssicola, n. sp.,					×			
Chirodota ferruginea, Verrill,					×			
lævis, Fabricius,					× ?			
rotifera, Pourtalès,						×		×
Myriotrochus rinkii, Steenstrup,	×							
Haplodactyla holothurioides, Cuvier,					×			
Trochostoma boreale, Sars,						×		
thomsonii, Danielsen and Koren,					× *n*			
turgidum, Verrill,					×			
ooliticum, Pourtalès,					×			
albicans, n. sp.,					× *n*			
sp. (?),								× *s*
Caudina arenata, Gould,					×			
Cucumaria grubii, von Marenzeller,				×				
quinquesemita, Selenka,					× ?			
planci, Brandt,		× ?	×	×				
lactea, Forbes,	×	×						
calcigera, Stimpson,					×			
elongata, Düben and Koren,	×	×	×	×				
tergestina, Sars,				×				
cucumis, Risso,				×				
hyndmanni, Thompson,	×	×		×				
kirchsbergii, Heller,				×				
frondosa, Gunnerus,	×	×			×			

TABLE II.—*continued.*

	Scandinavia, south of the Arctic Circle.	British Islands and France.	Spain, Portugal, Azores Islands.	Mediterranean Sea.	East Coast of North America, from Maine to Florida, including Bermudas.	West Indies, incl. Florida, G. of Mexico, East Coast of Central America and South America, as far as the River Amazon.	West Coast of Africa, including Madeira, Canary Islands, &c.	East Coast of South America.
Cucumaria frondosa, var. *mediterranea*, Semper,				×				
köllikeri, Semper,				×				
syracusana, Grube,				×			×	
punctata, Ludwig,						×		
nobilis, Ludwig,	× ?							
perspicua, Ludwig,	× ?							
minuta, Fabricius,		×		× ?				
assimilis, Düben and Koren,	×				×			
lefevrii, Barrois,		×						
saxicola, Brady and Robertson,		×						
cognata, Lampert,						×		
Echinocucumis typica, Sars,	×	×				×		
Colochirus pygmæus, n. sp.,								×
Thyone suspecta, Ludwig,						×		
surinamensis, Semper,						×		
briareus, Lesueur,					×	×		× ?
fusus, O. F. Müller,	×	×		×				
scabra, Verrill,					×			
raphanus, Düben and Koren,	×	×		×				
poucheti, Barrois,		×						
aurantiaca, Costa,				×			× *n* ?	
gemmata, Pourtalès,					×	×		
pulcherrima, Ayres,					×			
peruana, Lesson,					×	×		
glabra, Ayres,					× *n*			
musculosa, Ayres,					× *n*			
inermis, Heller,				×				
elongata, Ayres,					× *n*			
pervicax, n. sp.,								×
Stereoderma unisemita, Ayres,					× *n*		× ?	
Thyonidium drummondii, Thompson,	×	×						
productum, Ayres,					× *n*			
pellucidum, Fleming,	×	×				×		
marionii, v. Marenzeller,				×				
parvum, Ludwig,								×
occidentale, Ludwig,						×		
flavum, Greeff,							×	

TABLE II.—*continued.*

	Scandinavia, south of the Arctic Circle.	British Islands and France.	Spain, Portugal, Azores Islands.	Mediterranean Sea.	East Coast of North America, from Maine to Florida, including Bermudas.	West Indies, incl. Florida, G. of Mexico, East Coast of Central America and South America, as far as the River Amazon.	West Coast of Africa, including Madeira, Canary Islands, &c.	East Coast of South America.
Thyonidium ehlersi, Heller,				×				
Orcula punctata, Selenka,					×			
Phyllophorus dobsoni, Bell,						×		
urna, Grube,				×				
granulatus, Grube,				×				
Psolus regalis, Verrill,					× *n*			
phantapus, Strussenfeldt,	×	×			× *n*			
fabricii, Düben and Koren,					× *n*			
squamatus, Düben and Koren,	× *n*	×			× *n*			
operculatus, Pourtalès,						×		×
murrayi, n. sp.,								×
antarcticus, Philippi,								×
Rhopalodina lagœniformis, Gray,							×	
Stichopus haytiensis, Semper,						×		
errans, Ludwig,						×		
möbii, Semper,						×		
tizardi, Théel,		×						
natans, Sars,	×							
regalis, Cuvier,		×		×				
maculatus, Greeff,							×	
assimilis, Bell,							×	
badionotus, Selenka,						×		
selenkæ, Barrois,		×						
Pseudostichopus villosus, n. sp.,					×			
Mülleria flavo-castanea, n. sp.,							×	
parvula, Selenka,						×		
agassizii, Selenka,						×		
Holothuria glaberrima, Selenka,						×		
lubrica, Selenka,						×		
catanensis, Grube,			×	×				
languens, Selenka,						×		
intestinalis, Ascanius and Rathke,	×	×						
surinamensis, Ludwig,						×		
tremula, Gunner,	×	×						
atra, Jæger,						×		
atra, var. *amboinensis*,						×		
grisea, Selenka,						×	×	×
mexicana, Ludwig,						×		

TABLE II.—*continued.*

	Scandinavia, south of the Arctic Circle.	British Islands and France.	Spain, Portugal, Azores Islands.	Mediterranean Sea.	East Coast of North America, from Maine to Florida, including Bermudas.	West Indies, incl. Florida, G. of Mexico, East Coast of Central America and South America, as far as the River Amazon.	West Coast of Africa, including Madeira, Canary Islands, &c.	East Coast of South America.
Holothuria unicolor, Selenka,						×		
farcimen, Selenka,			×					
captiva, Ludwig,						×		
poli, Delle Chiaje,		×		×			×	
sanctori, Delle Chiaje,				×				
subditiva, Selenka,						×		
sulcata, Ludwig,						×		
occidentalis, Ludwig,						×		
helleri, von Marenzeller,				×				
tubulosa, Gmelin,		×	×	×			×	
stellati, Delle Chiaje,				×				
mammata, Grube,				×				
rigida, Selenka,						×		
princeps, Selenka,						×		
impatiens, Forskaal,				×		×		
arenicola, Semper,						×		
cubana, Ludwig,						×		
africana, n. sp.,							× *s*	
lactea, n. sp.,					× *n*			
murrayi (var. ?),					× *n*			
inornata, Semper,								×
nigra, Peach, Foot,		×						
enalia, Lampert,								×

TABLE III.—Indian and Pacific Oceans, including Australia, Sunda Islands, &c.

	Indian Ocean.		Sunda Islands, Philippine Islands, China Sea, and Bay of Bengal, Moluccas Islands, Waygeoo, &c.	Australia.		Pacific Ocean.				
	East Coast of Africa to Cape of Good Hope, incl. Madagascar, Mauritius, &c.	Red Sea and Gulf of Aden.		New Guinea, North Australia, and Queensland.	New Zealand, South Australia, New South Wales, and Victoria.	Japan Islands, Yellow Sea, and Bonin Island.	Polynesia.	West Coast of North America.	West Coast of Central America.	West Coast of South America.
Anapta gracilis, Semper,			×							
Synapta kefersteinii, Selenka,		×					×			
tenuis, Quoy and Gaimard,							×			
beselii, Jæger,	×	×	×				×			
vittata, Forskaal,		×								
nigra, Semper,		×	×		×					
glabra, Semper,			×				×			
grisea, Semper,		×	×	×						
serpentina, J. Müller,	×		×							
godeffroyi, Semper,	×						×			
inhærens, O. F. Müller,		×								
indivisa, Semper,			×							
recta, Semper,			×							
albicans, Selenka,								×		
ooplax, von Marenzeller,						×				
reticulata, Semper,			×							
uncinata, Hutton,					×					
petersi, Semper,			×							
asymmetrica, Ludwig,			×							
dubia, Semper,			×							
incerta, Ludwig,			×							
var. *variabilis*, n.,						×				
bidentata, Woodward and Barrett,			×							
molesta, Semper,			×							
similis, Semper,			×							
bankensis, Ludwig,			×							
innominata, Ludwig,			×							
pseudo-digitata, Semper,			×							
distincta, von Marenzeller,			×			×				
autopista, von Marenzeller,						×				
inequalis, Hutton,					×					
verrilli, n. sp.,				×						
insolens, n. sp.,				×						
aculeata, n. sp.,						×				
challengeri, n. sp.,							×			

TABLE III.—*continued.*

	Indian Ocean.			Australia.		Pacific Ocean.				
	East Coast of Africa to Cape of Good Hope, incl. Madagascar, Mauritius, &c.	Red Sea and Gulf of Aden.	Sunda Islands, Philippine Islands, China Sea, and Bay of Bengal, Molucca Islands, Waygeoo, &c.	New Guinea, North Australia, and Queensland.	New Zealand, South Australia, New South Wales, and Victoria.	Japan Islands, Yellow Sea, and Bonin Island.	Polynesia.	West Coast of North America.	West Coast of Central America.	West Coast of South America.
Chirodota japonica, von Marenzeller,					×	×				
studerii, Théel,							×			
australiana, Stimpson,					×					
dunedinensis, Jeffrey Parker,					×					
violacea, Peters, J. Müller,	×									
eximia, Haacke,	×									
rigida, Semper,			×							
incongrua, Semper,			×							
variabilis, Semper,			×	×		×				
vitiensis, Gräffe, Semper,							×			
dubia, Semper,			×							
panaensis, Semper,			×							
rubeola, Quoy and Gaimard,							×			
Ankyroderma roretzii, von Marenzeller,						×				
simile, n. sp.,						×				
marenzelleri, n. sp.,					×					
Haplodactyla molpadioides, Semper,			×							
australis, Semper,			×							
hyaloeides, Sluiter,			×							
Trochostoma arenicola, Stimpson,								×		
violacea, Studer,					×					
antarcticum, n. sp.,										× 8
albicans, var. *glabra*, n.,					×					
Trochostoma sp. (?),										× 8
Trochostoma sp.,										× 8
Caudina ransonnetii, v. Marenzeller,						×				
coriacea, Hutton,					×					
caudata, Sluiter,			×							
Molpadia chilensis, J. Müller,										×
australis, Semper,				×	×					
Cucumaria godeffroyi, Semper,										×
maculata, Semper,			×		×					
crucifera, Semper,		×								
glaberrima, Semper,		×								
quinquesemita, Selenka,								×		
planci, Brandt,	× ?									
leonina, Semper,			×							
miniata, Brandt,								× ?		

TABLE III.—*continued.*

	Indian Ocean.			Australia.		Pacific Ocean.				
	East Coast of Africa to Cape of Good Hope, incl. Madagascar, Mauritius, &c.	Red Sea and Gulf of Aden.	Sunda Islands, Philippine Islands, China Sea, and Bay of Bengal, Moluccа Islands, Waygeoo, &c.	New Guinea, North Australia, and Queensland.	New Zealand, South Australia, New South Wales, and Victoria.	Japan Islands, Yellow Sea, and Bonin Island.	Polynesia.	West Coast of North America.	West Coast of Central America.	West Coast of South America.
Cucumaria echinata, von Marenzeller,						×				
populifer, Stimpson,								×		
citrea, Semper,			×							
nigricans, Brandt,								×		
semperi, Bell,				×						
chronhjelmi, n. sp.,								× *n*		
improvisa, Ludwig,	× *s*									
ignava, Ludwig,					×					
africana, Semper,	×									
exigua, Ludwig,			×							×
tenuis, Ludwig,			×							
frauenfeldi, Ludwig,	× *s*		×							
californica, Semper,								×		
japonica, Semper,						×		× *n*		
frondosa, Gunnerus,			× ?					×		
dubiosa, Semper,										×
parva, Ludwig,										×
canescens, Semper,			×							
longipeda, Semper,			×			×				
conjungens, Semper,			×							
salmini, Ludwig,			×							
versicolor, Semper,			×							
panamensis, Verrill,									×	
mirabilis, n. sp.,			×		×					
capensis, n. sp.,	× *s*									
discolor, n. sp.,	× *s*									
thomsoni, Hutton,					×					
turbinata, Hutton,					×					
obunca, Lampert,						×				
sykion, Lampert,	× *s*									
abyssorum, var. *grandis*, n.,								× *s*		
var. *hyalina*, n.,								× *s*		
insolens, n. sp.,	× *s*									
multipes, n. sp.,						×				
posthuma, Lampert,	× *s*		×							
jägeri, Lampert,	× *s*									
Ocnus pygmæus, Semper,			×							
imbricatus, Semper,			×							

TABLE III.—*continued.*

	Indian Ocean.			Australia.		Pacific Ocean.				
	East Coast of Africa to Cape of Good Hope, incl. Madagascar, Mauritius, &c.	Red Sea and Gulf of Aden.	Sunda Islands, Philippine Islands, China Sea, and Bay of Bengal, Moluccas Islands, Waygeoo, &c.	New Guinea, North Australia, and Queensland.	New Zealand, South Australia, New South Wales, and Victoria.	Japan Islands, Yellow Sea, and Bonin Island.	Polynesia.	West Coast of North America.	West Coast of Central America.	West Coast of South America.
Ocnus javanicus, Sluiter,			×							
molpadioides, Semper,			×							
typicus, n. sp.,			×							
Echinocucumis adversaria, Semper,			×							
Colochirus spinosus, Quoy and Gaimard,			×		×					
inornatus, v. Marenzeller,						×				
quadrangularis, Lesson,	× ?		×		×					
jagorii, Semper,			×							
tristis, Ludwig,	×									
minutus, Ludwig,				×						
australis, Ludwig,				×	×					
australis, var. *armatus*, v. Marenzeller,						×				
cylindricus, Semper,			×							
cucumis, Semper,			×			×				
peruanus, Semper,										×
tuberculosus, Quoy and Gaimard,			×	×	×	×	×			
viridis, Semper,			×							
colloradiatus, Haacke,	×									
propinquus, Haacke,	×									
violaceus, n. sp.,			×							
challengeri, n. sp.,				×						
Actinocucumis typica, Ludwig,			×	×						
difficilis, Bell,		×		×						
Pseudocucumis acicula, Semper,	×		×				×			
Amphicyclus japonicus, Bell,						×				
Eucyclus duplicatus, Lampert,										×
Thyone venusta, Semper,		×								
villosa, Semper,			×							
buccalis, Stimpson,				×	×					
rosacea, Semper,		×								
cunninghami, Bell,										× *s*
ovulum, Selenka,								× *s*		
mirabilis, Ludwig,				×						
sacella, Selenka,	×	×	×	×		×				
gibber, Selenka,									×	
okeni, Bell,					×					
chilensis, Semper,										×

TABLE III.—*continued.*

	Indian Ocean.			Australia.		Pacific Ocean.				
	East Coast of Africa to Cape of Good Hope, incl. Madagascar, Mauritius, &c.	Red Sea and Gulf of Aden.	Sunda Islands, Philippine Islands, China Sea, and Bay of Bengal, Moluccа Islands, Waygeoo, &c.	New Guinea, North Australia, and Queensland.	New Zealand, South Australia, New South Wales, and Victoria.	Japan Islands, Yellow Sea, and Bonin Island.	Polynesia.	West Coast of North America.	West Coast of Central America.	West Coast of South America.
Thyone peruana, Lesson,										×
pedata, Semper,			×							
longidentis, Hutton,					×					
brevidentis, Hutton,					×					
meridionalis, Bell,					×					
fusus, var. *papuensis*, n.,				×						
curvata, Lampert,	×									
Stereoderma murrayi, Bell,		×								
validum, Bell,			×	×	×					
Thyonidium cebuense, Semper,			×							
magnum, Ludwig,			×							
caudatum, Hutton,					×					
japonicum, v. Marenzeller,						×				
schmeltzii, Ludwig,				×	×		×			
molle, Selenka,										×
rugosum, n. sp.,					×					
Orcula limaconotus, Brandt,						×				
tenera, Ludwig,		×					×			
hypsipyrga, von Marenzeller,						×				
cucumiformis, Semper,	×			×						
Phyllophorus perspicillum, Selenka,					×					
incompertus, n. sp.,					×					
ehrenbergii, Selenka,		×								
frauenfeldi, Ludwig,		×								
proteus, Bell,				×						
gracilis, Selenka,		×								
tenuis, Haacke,	×									
Psolus ornatus, Verrill,									×	
complanatus, Semper,			×							
boholensis, var. *pandanensis*, Semper,			×							
boholensis, Semper,			×							
fabricii, Düben and Koren,						×				
cataphractus, Selenka,					×					
ambulator, Bell,					×					
appendiculatus, Blainville,	×									
antarcticus, Philippi,										× *s*?
squamatus, Düben and Koren,										× *s*
Labidodemas semperianum, Selenka,							×			

TABLE III.—*continued.*

	Indian Ocean.			Australia.		Pacific Ocean.				
	East Coast of Africa to Cape of Good Hope, incl. Madagascar, Mauritius, &c.	Red Sea and Gulf of Aden.	Sunda Islands, Philippine Islands, China Sea, and Bay of Bengal, Moluccа Islands, Waygeoo, &c.	New Guinea, North Australia, and Queensland.	New Zealand, South Australia, New South Wales, and Victoria.	Japan Islands, Yellow Sea, and Bonin Island.	Polynesia.	West Coast of North America.	West Coast of Central America.	West Coast of South America.
Labidodemas selenkianum, Semper,							×			
dubiosum, Ludwig,							×			
Stichopus chloronotus, Brandt,	×		×				×			
möbii, Semper,			×							
horrens, Selenka,							×			
godeffroyi, var. *b*, Semper,			×				×			
variegatus, Semper,	×	×	×	×			×			
fusus, Ludwig,										× *s*?
naso, Semper,			×							
godeffroyi, Semper,							×			
var. *pygmæus*, Semper,							×			
japonicus, Selenka,			×			×				
var. *typicus*, n.,						×				
kefersteinii, Selenka,								× *s*		
ananas, Jæger,			×	×			×			
armatus, Selenka,			× ?			×				
(?) *torvus*, n. sp.,									× *s*	
moseleyi, n. sp.,										× *s*
sordidus, n. sp.,					×					
paradoxus, Lampert,				×						
Pœlopatides confundens, n. sp.,									× *s*	
aspera, n. sp.,			×							
appendiculata, n. sp.,						×				
Pseudostichopus mollis, n. sp.,										× *s*
villosus, n. sp.,									×	
Mülleria nobilis, Selenka,	×	×	×				×			
hadra, Selenka,							×			
excellens, Ludwig,							×			
formosa, Selenka,	×		×							
obesa, Selenka,							×			
miliaris, Quoy and Gaimard,	×	×	×	×			×			
lecanora, Jæger,	×		×			×	×			
echinites, Jæger,	×	×	×				×			
parvula, Selenka,	×	×	×				×			
mauritiana, Quoy and Gaimard,	×	×	×				×			
guamensis, Quoy and Gaimard,							×			
Holothuria marmorata, Jæger,	×		×	×		×	×			
argus, Jæger,	×		×				×			

TABLE III.—*continued.*

	Indian Ocean.		Sunda Islands, Philippine Islands, China Sea, and Bay of Bengal, Moluccs Island, Waygeoo, &c.	Australia.		Pacific Ocean.				
	East Coast of Africa to Cape of Good Hope, incl. Madagascar, Mauritius, &c.	Red Sea and Gulf of Aden.		New Guinea, North Australia, and Queensland.	New Zealand, South Australia, New South Wales, and Victoria.	Japan Islands, Yellow Sea, and Bonin Island.	Polynesia.	West Coast of North America.	West Coast of Central America.	West Coast of South America.
Holothuria vitiensis, Semper,							×			
tenuissima, Semper,		×	×				×			
koellikeri, Semper,	×						×			
clemens, Ludwig,			×				×			
similis, Semper,			×							
glaberrima, Selenka,								× *s* ?	×	
lubrica, Selenka,			×					× *s*		
moebii, Ludwig,	×		×							
erinaceus, Semper,			×	×			×			
paradoxa, Selenka,							×			
marenzelleri, Ludwig,						×				
languens, Selenka,									×	
pertinax, Ludwig,							×			
imitans, Ludwig,							×			
dietrichii, Ludwig,			×	×						
modesta, Ludwig,		×		×						
gräffei, Semper,			×				×			
flavo-maculata, Semper,			×				×			
fusco-coerulea, n. sp.,							×			
pulchella, Selenka,	×	×	×			×	×			
pervicax, Selenka,	×	×	×		×		×			
atra, Jæger,	×	×	×				×			
atra, var. *amboinensis*,	×		×				×			
pulla, Selenka,	× ?		×							
pyxis, Selenka,			×							
inornata, Semper,								× *s*		
edulis, Lesson,	×	×	×	× ?			×			
monacaria, Lesson,	×		×		×		×			
decorata, v. Marenzeller,	×					×				
macleari, Bell,	×			×						
humilis, Selenka,							×			
vagabunda, Selenka,	×	×	×	×			×			×
lagœna, Haacke,	×	×								
difficilis, Semper,	×						×			
strigosa, Selenka,	×	×								
curiosa, Ludwig,			×	×			×			
fusco-cinerea, Jæger,		×	×			×	×			
fusco-rubra, n. sp.,							×			

TABLE III.—*continued.*

	Indian Ocean.		Sunda Islands, Philippine Islands, China Sea, and Bay of Bengal, Moluccas Island, Waygeoo, &c.	Australia.		Pacific Ocean.				
	East Coast of Africa to Cape of Good Hope, incl. Madagascar, Mauritius, &c.	Red Sea and Gulf of Aden.		New Guinea, North Australia, and Queensland.	New Zealand, South Australia, New South Wales, and Victoria.	Japan Islands, Yellow Sea, and Bonin Island.	Polynesia.	West Coast of North America.	West Coast of Central America.	West Coast of South America.
Holothuria signata, Ludwig,							×			
pardalis, Selenka,	×	×	×	×	×	×	×			
subditiva, Selenka,									×	
lineata, Ludwig,	×	×		×						
peregrina, Ludwig,				×			×			
insignis, Ludwig,	×	×	×	×						
inhabilis, Selenka,							×			
rugosa, Ludwig,			×				×			
discrepans, Semper,							×			
immobilis, Semper,	×		×							
cæsarea, Ludwig,							×			
samoana, Ludwig,		× ?					×			
notabilis, Ludwig,				×						
pleuripus, Haacke,	×									
bowensis, Ludwig,				×						
rigida, Selenka,	×	×					×			
coluber, Semper,			×							
chilensis, Semper,										×
kubaryi, Ludwig,							×			
impatiens, Forskaal,	×	×	×	×			×		×	
gracilis, Semper,	×		×				×			
arenicola, Semper	×	×	×			×	×			
verrucosa, Selenka,	×						×			
scabra, Jæger,	×	×	×	×			×			
aculeata, Semper,			×							
fusco-punctata, Jæger,			×							
albiventer, Semper,	×	×	×							
martensii, Semper,			×	×						
squamifera, Semper,		×	×				×			
minax, n. sp.,						×				
spinifera, n. sp.,			×							
ocellata, Jæger,				×						
lactea, n. sp.,					×					
thomsoni, n. sp.,						×		× *n*		
murrayi, n. sp.,								× *s*		
var. *parva*, n.,							×			
holothuroides, Sluiter,			×							
occidentalis, Ludwig,	×									

TABLE III.—*continued.*

	Indian Ocean.		Sunda Islands, Philippine Islands, China Sea, and Bay of Bengal, Moluccа Island, Waygeoo, &c.	Australia.		Pacific Ocean.				
	East Coast of Africa to Cape of Good Hope, incl. Madagascar, Mauritius, &c.	Red Sea and Gulf of Aden.		New Guinea, North Australia, and Queensland.	New Zealand, South Australia, New South Wales, and Victoria.	Japan Islands, Yellow Sea, and Bonin Island.	Polynesia.	West Coast of North America.	West Coast of Central America.	West Coast of South America.
Holothuria monosticha, Haacke,	×									
aphanes, Lampert,		×								
remollescens, Lampert,		×								
truncata, Lampert,				×						
klunzingeri, Lampert,		×								
parva, Lampert,	×									

Notes.—In the tables most of the doubtful species have been excluded.
×*n* or ×*s* signify that the species is found in the northern or southern part of the province indicated by the column.
× placed "on a line" means, that only the ocean or land is known, but no definite locality is assigned.

The above Tables certainly communicate a fairly correct idea of the distribution of the Holothurioidea, so far as is at present known, but it must be remembered that great parts of the world have not yet been explored, and that every year new forms are found on our own coast, proving that our present knowledge of the geographical distribution is very incomplete, and does not enable us to speak with any confidence. Considering this, as well as the fact that scarcely anything is known about fossil Holothurids, only a few general conclusions, which seem to be established, may be mentioned.

With respect to the arctic and antarctic regions, the observations hitherto made seem to establish that not a single species of the Holothurioidea is common to both seas. Notwithstanding this the shallow-water fauna of the two regions possesses much the same features. Thus the northern forms *Cucumaria frondosa*, *Trochostoma borealis*, *Psolus squamatus*, *Psolus fabricii*, *Holothuria intestinalis*, &c., are represented in the Antarctic Sea by *Cucumaria lævigata*, *Cucumaria crocea*, *Trochostoma violacea*, *Psolus ephippifer*, *Psolus antarcticus*, and *Holothuria magellani*. I have had all these forms at my disposal, with the exception of *Holothuria magellani*, and they appear to be distinct from one another, though the distinguishing characters, it must be confessed, often seem to be rather inconsiderable and possibly not of specific value. It is, however, of importance not to neglect such small characters, which unquestionably have a much greater consequence than may be at first supposed. According to my opinion, every example proving that the arctic and antarctic shallow-water faunæ are different is of value, for I cannot conceive how it is possible that they can have animals which are

entirely similar. Of course, I do not take into consideration such forms as pass their existence on the bottom of the deep-sea or at the surface of the ocean. It appears scarcely probable that the shore fauna of two regions so far separated from each other as the arctic and antarctic seas, has any direct exchange of forms at the present epoch, so as to allow the same species, in its larval or adult state, to pass from one pole to the opposite without settling at interjacent regions. In brief, I do not believe that at the present epoch the arctic shallow-water fauna can directly originate from the antarctic, or *vice versa*.

On the other hand, it is a fact that the two faunæ in question resemble each other very closely, and, with regard to the Holothurids, that several forms occur in the arctic sea which are most closely allied to those in the antarctic. I am inclined to suppose that the progenitors of these Holothurids have had a much wider distribution during a past period, that altered physical conditions, a keener struggle for existence, &c., under the tropic and the temperate zones have effected their extinction, or their migration towards the polar seas, or even produced changes in their organisation and general appearance so marked, that their descendants which still remain in the tropical zones present themselves as species distinct from the original, and finally that the polar seas with their more uniform physical conditions, allowed them and their descendants to live there and to develop slowly but continuously after almost the same plan.

The genus *Psolus* offers an instructive example of forms which are distributed over all seas from the Arctic Ocean to the Antarctic, and which are so very little differentiated that we scarcely acknowledge them as distinct species. Thus the northern species, *Psolus squamatus* and *Psolus fabricii* pass imperceptibly into *Psolus operculatus*, *Psolus complanatus*, and several other tropical or subtropical forms, which in their turn are replaced towards the antarctic regions by *Psolus antarcticus* and *Psolus ephippifer*, &c. But it must be observed that all these forms of *Psolus*, though they apparently present great similarities, are nevertheless distinguishable, though the differences may or may not be of specific value. It appears pretty evident that they are all descendants from the same ancestors, which may have had their origin in the polar seas or in the tropic or subtropic oceans, and that they, in their wide dispersion, have sustained very well the influence of altered and very various physical conditions in different regions of the world. But, of course, different physical conditions and an altered mode of life have caused some small deviations in internal and external organisation.

With regard to the remaining species of Holothurids mentioned above, I think the same is or has been the case. Forms intermediate between those in the arctic and those in the antarctic seas, are either still living in interjacent regions, having undergone alterations of a more or less adaptive nature, or they have succumbed.

As a fact, numerous arctic forms of animals are "circumpolar," and among the Holothurioidea, *Myriotrochus rinckii*, *Chirodota lævis*, *Cucumaria calcigera*, *Cucumaria*

frondosa, Poslus fabricii, and possibly *Psolus phantapus*, appear to be distributed round or nearly round the pole.

Only a few Holothurids, viz., *Holothuria atra* and *Holothuria impatiens*, are with certainty known to be "circumequatorial," and *Holothuria occidentalis, Holothuria rigida, Mülleria parvula*, and several others may doubtless be proved to have the same wide distribution. Considering the great conformity between the Holothurids in the Indian and Pacific Oceans, it does not appear improbable that an exchange of forms is still going on between the Pacific and Atlantic Oceans, and that this takes place round the south coast of Africa. There is great probability that the currents in the Atlantic Ocean, as well as in other seas, transport animals in the larval state from one coast to another. No shallow-water Holothurid is, of course, known to be completely cosmopolitan.

Though our present knowledge with regard to the distribution of the Holothurids is too insufficient to establish definite features of the different oceans, a few points which are probably accurate may be mentioned.

The Arctic Ocean.—The Synaptidæ, in regard to the number of species, are very poorly represented. The genus *Synapta* has only a single representative, *Synapta inhærens*, and it, besides being very rare, is not a true arctic form. *Chirodota lævis* and *Myriotrochus rinckii*, on the contrary, are present in great numbers, and the latter as well as *Trochoderma elegans*, both very strange forms, may be said to give a character to the arctic fauna. Among the Molpadidæ, *Eupyrgus scaber* is singular in general appearance, and peculiar to the arctic ocean. The Dendrochirotæ have about twenty-five representatives, but not a single one of a remarkable shape except *Echinocucumis typica*, which is not a true arctic form. However, *Cucumaria frondosa*, one of the largest known Holothurids, abounds in several parts of the Arctic Sea, and gives the fauna a singular character, and the same may be said in a higher degree of the genus *Psolus*, which attains its maximum development in the northern seas, the three species *Psolus phantapus, Psolus fabricii*, and *Psolus squamatus*, being the largest known forms of this genus. The Aspidochirotæ are nearly absent, only two or three forms, *Holothuria intestinalis, Holothuria tremula* (?) and *Holothuria ecalcarea*, having been with certainty found in the southern part of the arctic region. With a few exceptions, *Cucumaria frondosa, Holothuria tremula* and *Trochstoma boreale*, the northern Holothurids are almost devoid of colouring matters in the integument.

The *Antarctic Fauna* is too insufficiently known to admit of any general statements.

The Atlantic Ocean.—The Atlantic Ocean, which can be divided into several regions, the North Atlantic, the South Atlantic, the West Indian and the Mediterranean, contains, as may be seen from the tables, a much greater number of shallow-water Holothurids than the Arctic Sea, but scarcely one can be said to characterise it. Of course there are many species hitherto known only from the Atlantic Ocean, but they do not in general present

any peculiar features, nor do they particularly abound. The very remarkable *Rhopalodina* has been hitherto only dredged at a single locality. In different regions different forms predominate; thus the Aspidochirotæ abound in species at the West Indies and also in other tropical or subtropical zones. The Mediterranean has a Holothurian fauna very different from that of the West Indies, but reminding one in several respects of that of the British and Scandinavian coasts.

The Indian and Pacific Oceans.—Considering the fact that while about forty-two species and varieties are known from the Arctic Ocean, thirty-two from the Antarctic, one hundred and thirty-five from the Atlantic and Mediterranean, but no less than about three hundred and five from the Indian and Pacific Oceans, there seems to be sufficient reason for the opinion that the Holothurids attain their maximum development in these latter seas. Here, as well as in the Atlantic Ocean, the tropical and temperate regions are the richest, while a diminution in the abundance of Holothurian life takes place towards the arctic and antarctic regions. The fact that among eighty-nine species hitherto known from the Indian Ocean, forty-nine are also found in the Pacific, evidently proves the great similarity between the two oceans, a similarity which will certainly be more striking when a greater part of the Indian Ocean is explored.

The genus *Synapta* is represented by no less than thirty-four species, of which some attain an enormous length; the large *Synapta beselii*, *Synapta glabra*, *Synapta grisea*, &c., are not only by their size, but even by their colour and external appearance, in a high degree characteristic of the oceans in question. The genera *Actinocucumis*, *Pseudocucumis*, *Amphicyclus* and *Eucyclus* are known only from these oceans, and show that those Dendrochirotæ which are marked by possessing more than ten tentacles, have been subjected to greater variations here than in the Atlantic Ocean. The singular genus *Colochirus* is very characteristic of the Holothurians of these oceans, and gives to them a peculiar stamp, for among eighteen known species, seventeen belong to the Indian and Pacific Oceans. Among the Aspidochirotæ, *Mülleria*, *Stichopus* and *Holothuria* abound in all places, and are represented by a very much greater number of forms than is the case in the Atlantic Ocean.

APPENDIX.

In December 1885, after the greater part of my Report had been printed off, Lampert's valuable work on the Holothurioidea appeared, necessitating some additions to this Report. In order to complete my monograph I subjoin a survey of the new forms described by Lampert; and the new localities mentioned in his work, of forms already known, are inserted in the geographical tables.

Holothuria anapinusa, Lampert, 1885.

Ventral surface with numerous closely placed pedicels, indistinctly arranged in longitudinal series. Dorsal surface with papillæ of variable size; along each side of the body, on the line of junction between the dorsal and ventral surfaces, there is a row of about six large papillæ with smaller ones between. A circle of papillæ surrounds the twenty tentacles. Deposits—tables alone, having the disk smooth on the margin, and regularly pierced with eight holes; their spire is built up of four rods and one transverse beam, and terminates in twelve to sixteen teeth.

Habitat.—Sörres Island (Lampert).

Considering the fact that the genital organs are unknown, it is uncertain whether this species belongs to the genus *Holothuria* or to *Stichopus*.

Holothuria aphanes, Lampert, 1885.

Ventral surface with pedicels arranged in three longitudinal double rows. Dorsal surface with minute, scattered papillæ, smaller than the pedicels. Tentacles (?). Deposits—tables alone, having the rather large smooth disk pierced with eight peripheral holes; their spire is built up of four rods and one transverse beam, and terminates in eight teeth. Besides these tables the pedicels possess others with a larger disk, a longer spire and several transverse beams.

Habitat.—Cosseir (Lampert).

According to Lampert, the single specimen examined is probably a young one.

Holothuria remollescens, Lampert, 1885.

Pedicels all over the body, closely placed on the ventral and sparsely on the dorsal surface. Tentacles twenty. Deposits—smooth buttons of the usual shape

with six holes; and tables which have the smooth disk pierced with four central and about twelve peripheral holes, and supporting a spire composed of four rods and one transverse beam, and terminating in about twelve teeth. Among these tables others are scattered which have the spire much longer, provided with three to four transverse beams, and terminating in only four teeth.

Habitat.—Cosseir (Lampert).

Holothuria truncata, Lampert, 1885.

Rather large papillæ all over the body. Tentacles eighteen. Deposits—smooth buttons of the usual shape with six holes; and very solid tables, which have the smooth disk perforated by eight peripheral holes and supporting a spire which is built up of four rods and one transverse beam, and which terminates in so great a number of teeth that the top of the spire becomes almost as wide as the disk itself.

Habitat.—Queensland (Lampert).

Holothuria klunzingeri, Lampert, 1885.

Sparsely scattered pedicels all over the body. Tentacles twenty. Deposits—buttons with six holes, and two knobs on the middle beam; and tables of the usual shape with small holes on the disk, and spines of varying number and size on its margin. The spire is composed of four rods and one transverse beam, and terminates in eight teeth. Sometimes the spire seems to be rather poorly developed.

Habitat.—Cosseir (Lampert).

The species is possibly not distinct from Ludwig's *Holothuria notabilis*.

Holothuria enalia, Lampert, 1885.

Ventral surface with irregularly scattered pedicels; dorsal surface with very sparsely placed small papillæ. Tentacles small and withdrawn into the body. Deposits —small, fenestrated plates of irregular shape; and tables completely devoid of disks or possessing simple annular ones. The spire is composed of four rods held together at their middle by one transverse beam, but not united at their free ends, which are simple, devoid of spines or teeth, and directed outwards.

Habitat.—Bahia (Lampert).

The species is nearly allied to *Holothuria atra* and *Holothuria grisea*, &c.

Holothuria parva, Krauss, Lampert, 1885.

Habitat.—Natal (Lampert).

The species scarcely seems to be distinguished from Semper's *Holothuria erinaceus*. Lampert, however, says that its deposits consist of short, solid, thick rods, pro-

vided with short, conical, simple spines, which not unfrequently present a great resemblance to those in *Phyllophorus frauenfeldi*, so that the spines are collected at the middle and at each end of the rods.

Stichopus paradoxus, Lampert, 1885.

Pedicels scattered all over the body, no arrangement in longitudinal series being discernible. Tentacles twenty. Deposits—tables with the disk smooth or irregularly spinous on the margin, pierced with four central holes and an irregular circle of peripheral ones, and supporting a spire which is built up of four rods and one transverse beam, and carries about ten large teeth on the margin of the very wide annular top; smooth buttons always with three pairs of holes, but not unfrequently asymmetrical; also C-shaped bodies.

Habitat.—New Holland (Lampert).

This species seems to be very well defined. No *Stichopus* was previously known which has pedicels on both the dorsal and ventral surfaces. Nor were the three kinds of deposits ever found before in the same species.

Cucumaria posthuma, Lampert, 1885.

Habitat.—Java, Table Bay and Cape of Good Hope (Lampert).

Synonymous with *Cucumaria frauenfeldi*, Ludwig, 1882. Compare page 109 of this Report. At the middle of the body the pedicels form three rows along each ambulacrum.

Cucumaria jägeri, Krauss, Lampert, 1885.

Body ovate, ventral pedicels arranged in four or five rows on each ambulacrum, dorsal pedicels in three or four. Deposits like those in *Cucumaria echinata*, but devoid of the long, characteristic, outwardly-directed spine; the deposits are very solid and covered with closely-placed knobs. Pedicels devoid of terminal plates. Calcareous ring robust and devoid of posterior prolongations.

Habitat.—Natal (Lampert).

Cucumaria obunca, Lampert, 1885.

Body-form like that in *Cucumaria cucumis*. A double row of about thirty retractile pedicels in each ambulacrum. Deposits—tables, consisting of an irregularly oval, smooth disk with undulated margin, perforated with four holes, and having the spire reduced to two knobs. Calcareous ring very fine, devoid of prolongations posteriorly.

Habitat.—Hakodadi, Japan (Lampert).

Cucumaria sykion (*Semperia*), Lampert, 1885.

Ventral surface with pedicels only on the ambulacra, placed in four or five irregular rows on each. Dorsal surface with pedicels on the ambulacra as well as on the interambulacra, though those on the latter are smaller. Deposits like those in *Cucumaria dubiosa*, Semper. Calcareous ring devoid of bifurcate prolongations posteriorly.

Habitat.—Algoa Bay (Lampert).

This species must be very nearly related to *Cucumaria dubiosa* and *Cucumaria köllikeri*, but is distinguished from them principally by the arrangement of the pedicels.

The genus *Semperia*, founded by Lampert, comprises all forms of Cucumariæ which have two or more rows of pedicels on the ambulacra, and also scattered ones on all the interambulacra, or on some of them. He retains the old name of the genus for all those species which have the pedicels arranged in two or more rows on the ambulacra alone. For my own part, I cannot understand the necessity of this separation, considering the very natural affinity between all or most of the species in question. Besides, it is the fact that a good many of those forms which would be referred to "*Semperia*," when they are young are provided with pedicels only on the ambulacra.

As is known, Semper grouped the dendrochirotous Holothurians under the three subfamilies, Stichopoda, Gastropoda, and Sporadipoda, according to the arrangement of the pedicels. Bell, in his paper on *Amphicyclus*, in 1884, gave particular attention to the position and number of the tentacles in the Dendrochirotes, and proposed the name "polychirote Dendrochirotæ" for those forms which have more than ten tentacles, and "decachirote Dendrochirotæ" for those with only ten tentacles. The views of Bell were recently adopted and further explained by Lampert, who places the dendrochirotous Holothurians under the two new subfamilies of "Decachirotæ" and "Polychirotæ," according as the tentacles are ten or more than ten; moreover, he divides the latter subfamily into two groups, "Monocyclia" and "Amphicyclia," according as the tentacles form a single or a double crown. I refrain from offering any opinion on the validity of this division, which in several respects, it must be confessed, seems to be better than that of Semper, but in others, especially from the view of natural relationship, can scarcely be satisfactory.

Cucumaria cognita (*Semperia*), Lampert, 1885.

Body tapered towards each extremity. Pedicels arranged in a double row along each ambulacrum, and also scattered over all the interambulacra at the swollen middle portion of the body. Towards the extremities of the body, where the interambulacra are naked, the pedicels become transformed into small, conical, white, rough papillæ; terminal plates absent. Deposits—elongated, smooth plates of a somewhat asymmetrical appearance, perforated with one or two irregular

rows of holes, thus resembling those in *Cucumaria tergestina*. Calcareous ring like that in *Cucumaria conjungens*.

Habitat.—Cuba and Fernando di Noronha (Lampert).

Thyone curvata, Lampert, 1885.

Body fusiform. Pedicels equally distributed all over the body. Deposits—roundish plates with about ten obtuse, rather large teeth round the margin, with four holes and four conical spines on the upper surface (=incomplete tables); also minute rosettes. Each of the ten pieces of the calcareous ring is composed of small parts, and the radial are prolonged into a posterior bifurcation.

Habitat.—Zanzibar (Lampert).

Thyone (*Thyonidium ?*) *lechleri*, Lampert, 1885.

Pedicels rather more densely placed on the ventral surface than on the dorsal. An arrangement of the pedicels in rows traceable along the ambulacra. Deposits—more or less irregularly roundish or oval, smooth swollen bodies, which are usually devoid of holes, but sometimes are pierced with one small hole or more, and present a concentric structure. All the ten pieces of the calcareous ring are almost equal, and each has a bifurcate prolongation posteriorly.

Habitat.—Strait of Magellan (Lampert).

From the scarcity of materials Lampert could not tell the number of tentacles; he is therefore dubious whether the species is a *Thyone* or a *Thyonidium*.

Orcula luminosa, Lampert, 1885.

Pedicels equally distributed all over the body. Deposits—large scattered tables, consisting of a disk pierced with four central holes and about eight peripheral ones, and carrying at each of its angles a short process; the robust spire is composed of four rods and one transverse beam; its top is irregularly spinous. Calcareous ring composed of ten simple pieces, devoid of bifurcate prolongations posteriorly.

Habitat.—Greenland (Lampert).

Pseudocucumis intercedens, Lampert, 1885.

Tentacles eighteen, in two crowns, those in the outer crown thirteen in number, unequal, and usually slightly larger than the five others which form the inner crown. Pedicels only present on the ambulacra, where they are irregularly placed, four or five side by side. Deposits—crowded tables like those in *Cucumaria versicolor*, consisting of an irregular, oval, smooth disk, usually pierced with four holes, and a long spire built up of two rods, and terminating in two long diverging teeth. Sometimes the disk becomes more elongated and provided with more than four holes. The spire itself shows two to four perforations.

Calcareous ring of ten simple pieces, devoid of prolongations posteriorly; the interradial carry anteriorly one point, the broad radial have four.

Habitat.—(?).

Genus Eucyclus, Lampert, 1885.

Tentacles twenty, in two crowns, each crown composed of ten equal tentacles; those of the inner crown smaller and radial in position, those of the outer crown larger and interradial. Pedicels equally distributed all over the body. Calcareous ring like that in *Thyone chilensis*, composed of only five simple pieces, devoid of prolongations posteriorly.

Eucyclus duplicatus, Lampert, 1885.

Body ovate, slightly curved. Deposits—sparsely scattered, small, tuberculated rods, slightly enlarged and usually perforated at each end, thus resembling those in *Thyone chilensis*.

Habitat.—Callao, Peru (Lampert).

A detailed comparison of the descriptions of *Eucyclus duplicatus* and *Thyone chilensis* clearly shows that the two forms are very nearly related, and that the only points of distinction are the number and arrangement of the tentacles. Supposing that Semper is right in stating the number of tentacles to be ten in his *Thyone chilensis*, it remains unexplained how it is possible that species of two different genera, which also belong to different subfamilies, can be developed in "every detail" like one another. For my own part I am very much tempted to think that Semper has made a mistake in counting the tentacles, in which case the two forms will be identical, but if he be right, there is still weighty reason for placing the two forms side by side, in spite of the differences in the number of tentacles, because they present the most obvious similarity in every other respect. I fear that the individual variations in regard to the tentacles in many Dendrochirotes may be much more extensive than has been hitherto supposed, and that this variation principally takes place in the "polychirote" Dendrochirotes. In all those Dendrochirotes, on the contrary, which are characterised by possessing only ten tentacles, *these* appear to be almost constant in number, size, and position. From deficient knowledge in these respects it does not seem very suitable at present to found the subfamilies above mentioned merely on the differences in the tentacles.

Lampert has associated with the following three forms, incompletely described by Rathbun, Anderson and Barrois, the names of their respective discoverers:—

Holothuria rathbunii, Lampert, 1885 = *Holothuria*, sp. mihi, p. 239.
Colochirus andersoni, Lampert, 1885 = *Holothuria*, sp. mihi, p. 240.
Semperia barroisi, Lampert, 1885 = *Thyone fusus*, mihi, p. 134.

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[1] This list indicates only the books and memoirs which are referred to in the text, and which treat of the systematic arrangement of the Holothurioidea. An * placed before a memoir signifies that I have not had the opportunity of seeing the original myself.

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zebrina, Held (Synapta), ... 23

PLATE I.

PLATE I.[1]

Fig. 1. *Synapta verrilli*, n. sp. *a*, anchor; *b*, anchor-plate; *c*, calcareous ring; *d*, miliary granules.

Fig. 2. *Synapta aculeata*, n. sp. *a–d*, anchors of various appearances; *e*, anchor-plate; *f*, miliary granules.

Fig. 3. *Synapta insolens*, n. sp. *a*, anchor; *b*, anchor-plate; *c*, miliary granules.

Fig. 4. *Synapta challengeri*, n. sp. *a*, anchor; *b*, anchor-plates; *c*, miliary granules; *d*, calcareous ring.

Fig. 5. *Synapta incerta*, var. *variabilis*, nov. Anchor-plates.

Fig. 6. *Synapta glabra*, Semper. *a*, anchor; *b*, anchor-plate; *c*, rosette-shaped bodies.

Fig. 7. *Synapta lappa*, Müller. *a*, anchor; *b*, anchor-plate; *c*, rosette-shaped bodies.

Fig. 8. *Synapta distincta*, von Marenzeller. *a*, anchor-plate; *b*, ×-shaped miliary granules; *c*, calcareous ring.

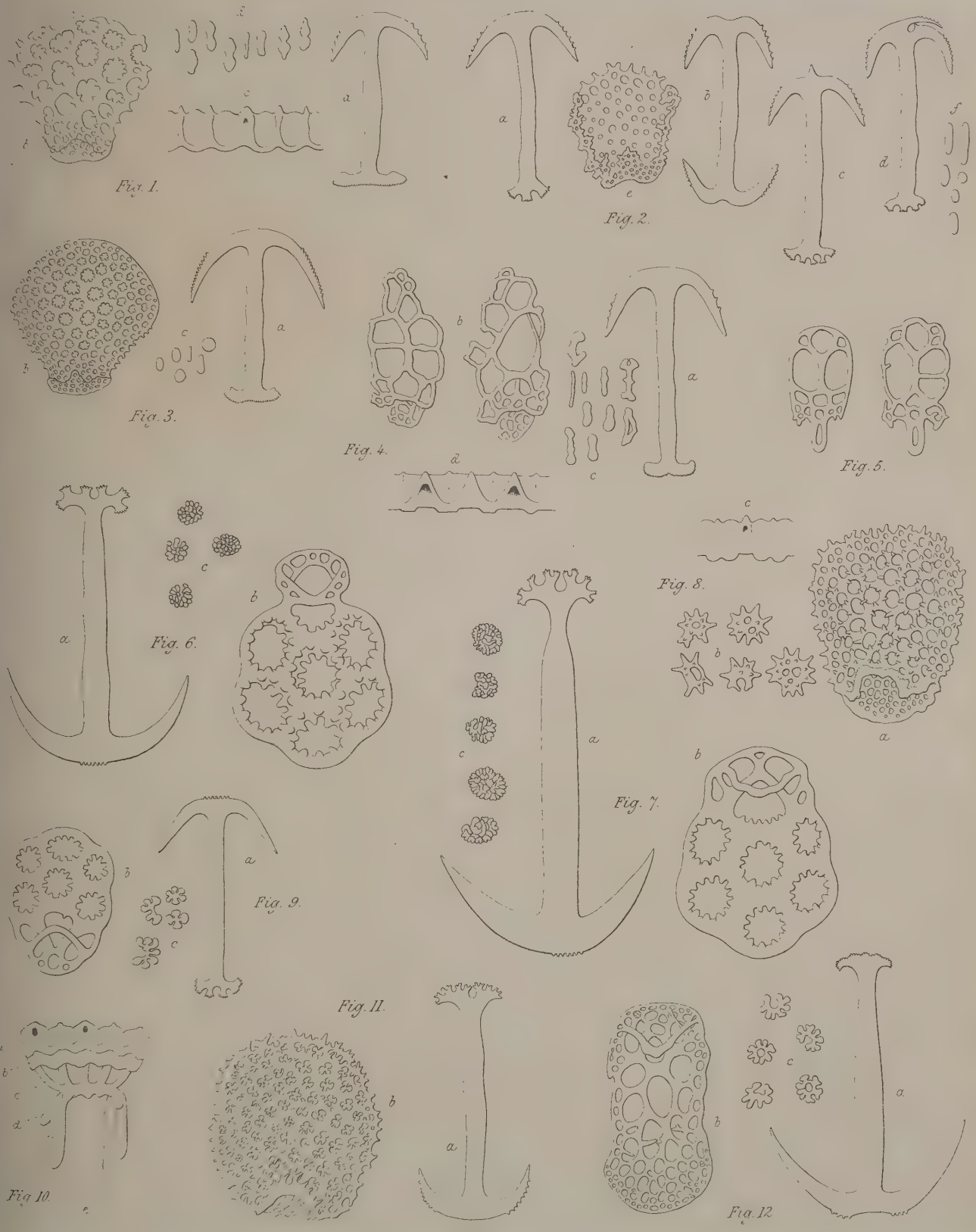
Fig. 9. *Synapta picta*, n. sp. *a*, anchor; *b*, anchor-plate; *c*, incomplete rosette-shaped granules.

Fig. 10. *Synapta picta*, n. sp. *a*, calcareous ring; *b*, ring made up of connective tissue; *c*, tentacular canals; *d*, Polian vesicles; *e*, œsophagus.

Fig. 11. *Synapta abyssicola*, n. sp. *a*, anchor; *b*, anchor-plate.

Fig. 12. *Synapta beselii*, Jæger. *a*, anchor; *b*, anchor-plate; *c*, rosette-shaped granules.

[1] Where no measurements are given, the figures are more or less strongly magnified. The natural size of the deposits is always mentioned in the text.



H. Théel & C. Kolthoff del. T. Huth, Lithr Edinr

1, SYNAPTA VERRILLI, n.sp. 2, SYNAPTA ACULEATA, n.sp. 3, SYNAPTA INSOLENS, n.sp. 4, SYNAPTA CHALLENGERI, n.sp.
5, SYNAPTA INCERTA, var. VARIABILIS, n. 6, SYNAPTA GLABRA, Semper. 7, SYNAPTA LAPPA, Müller.
8, SYNAPTA DISTINCTA, von Marenzeller. 9-10, SYNAPTA PICTA, n.sp. 11, SYNAPTA ABYSSICOLA, n.sp.
12, SYNAPTA BESELII, Jæger.

PLATE II.

PLATE II.

Fig. 1. *Chirodota purpurea*, Lesson. *a*, wheel; *b*, miliary granules.

Fig. 2. *Chirodota contorta*, Ludwig. *a*, wheel; *b*, sigma-shaped deposits.

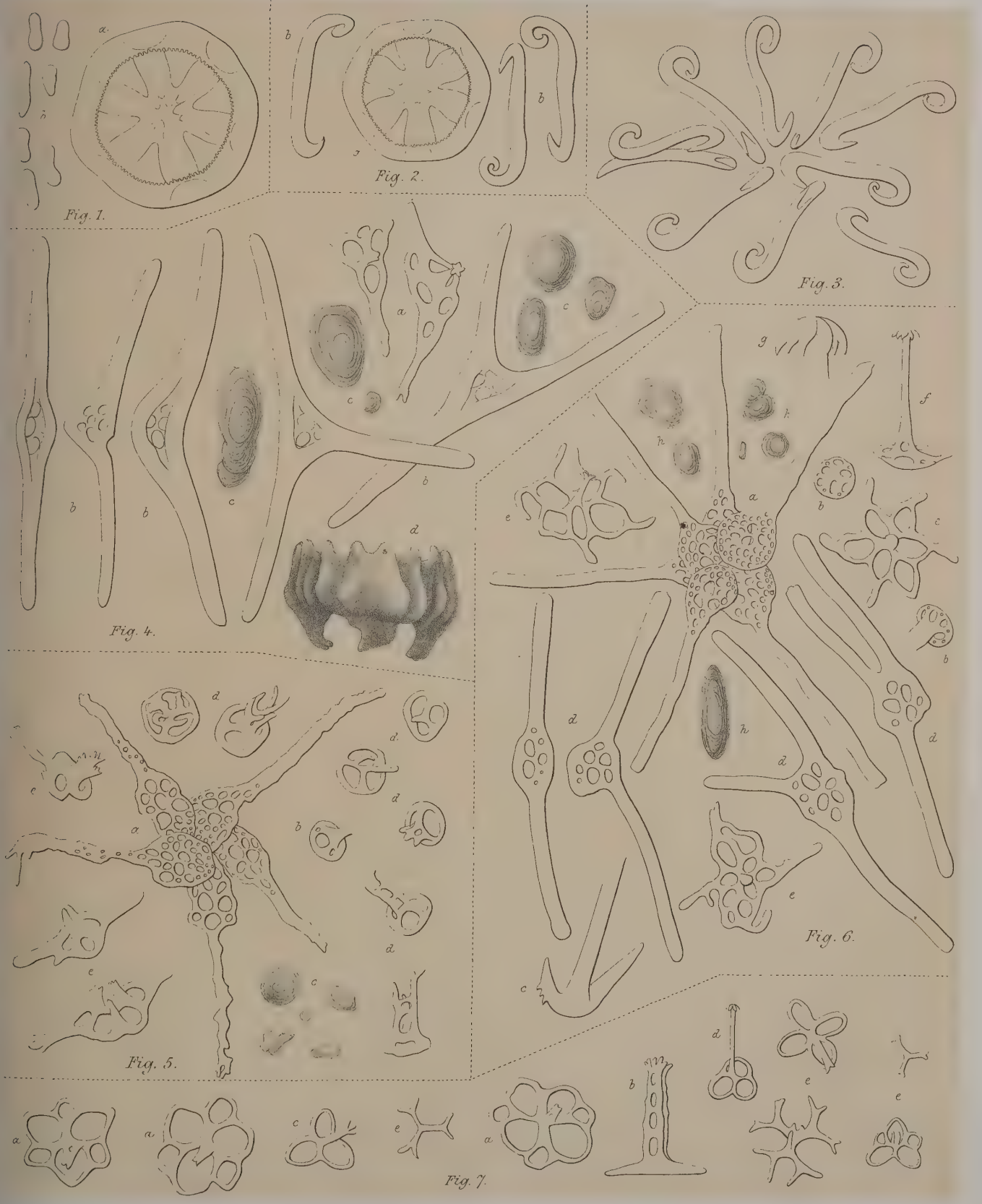
Fig. 3. *Chirodota japonica*, von Marenzeller. Group of sigma-shaped deposits.

Fig. 4. *Trochostoma violaceum*, Studer. *a*, small irregular, table-like deposits; *b*, large fusiform rods; *c*, wine-coloured deposits; *d*, calcareous ring.

Fig. 5. *Ankyroderma simile*, n. sp. *a*, stellate aggregation of spoon-like rods; *b*, basal portion of the central anchor-shaped rod; *c*, reddish deposits; *d*, table-like deposits; *e*, tables from the posterior extremity of the body.

Fig. 6. *Ankyroderma danielsseni*, n. sp. *a*, stellate aggregation of spoon-like rods; *b*, basal portions of the central anchor-shaped rod; *c*, the free end of the anchor; *d*, fusiform rods; *e*, small irregular plates with a central spine; *f*, minute deposits with the long central spine carrying hooks; *g*, the free end of such a spine, highly magnified.

Fig. 7. *Trochostoma antarcticum*, n. sp. *a*, tables with a less-developed spire; *b*, side view of a table with longspire and several transverse beams; *c* and *e*, different developmental stages of tables; *d*, minute table with hooks at the free end of the long spine.



H. Théel del.

F. Huth, Lith.r Edin.r

1, CHIRODOTA PURPUREA, Lesson. 2, CHIRODOTA CONTORTA, Ludwig. 3, CHIRODOTA JAPONICA, von Marenzeller.
4, TROCHOSTOMA VIOLACEUM, Studer. 5, ANKYRODERMA SIMILE, n. sp. 6, ANKYRODERMA DANIELSSENI, n. sp.
7, TROCHOSTOMA ANTARCTICUM, n. sp.

PLATE III.

PLATE III.

Fig. 1. *Molpadiodemas mercurellum*, n. sp. *a*, tables: *c*, basal portion of an anchor; *d*, the free end of an anchor; *e*, anchor-plates; *f*, smaller and larger yellowish or brownish deposits; *g*, anchor-plate which has begun to change in colour, a part of it still remaining colourless. Branched figures at left hand side show developmental stages of tables.

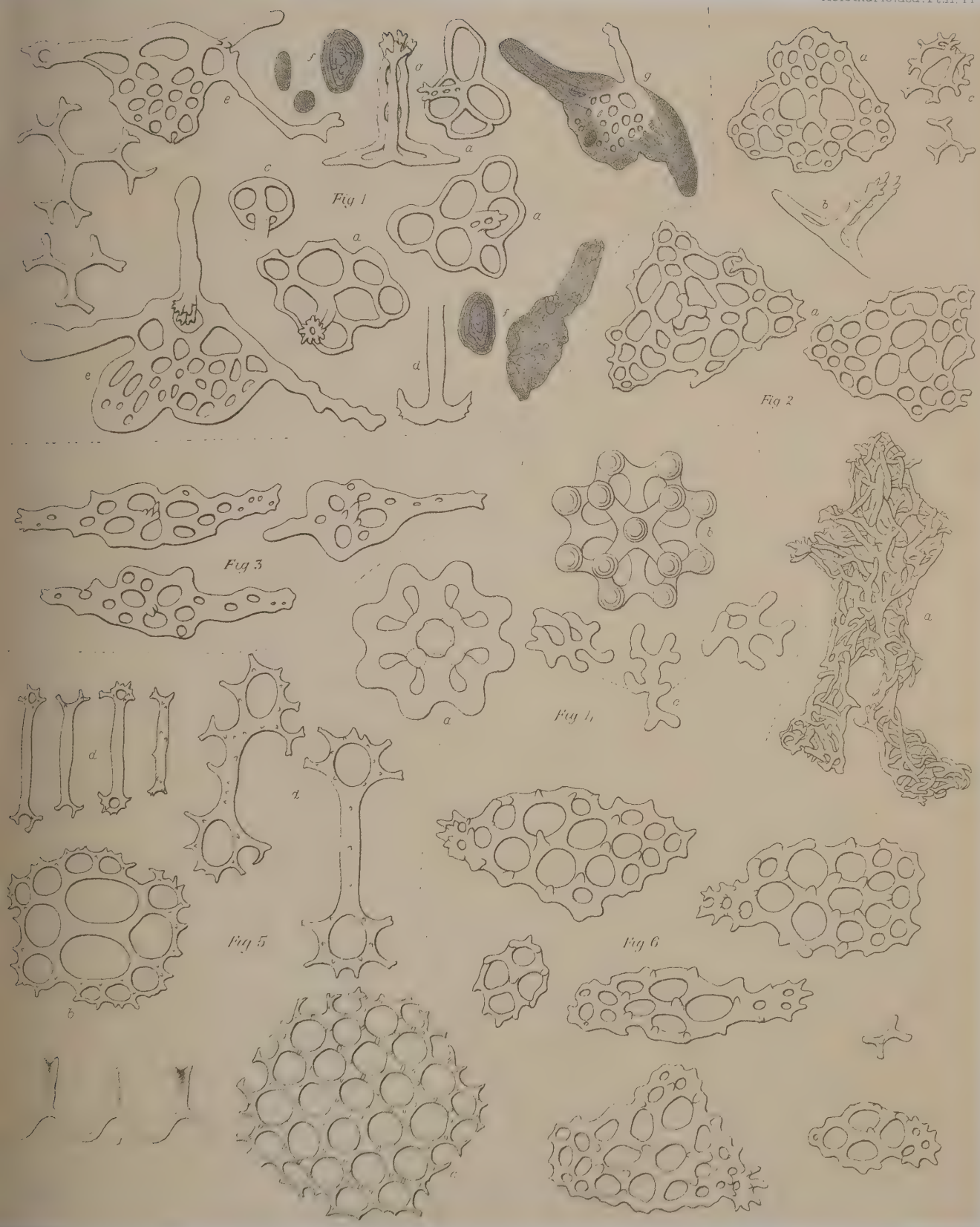
Fig. 2. *Trochostoma silicosa*, n. sp. *a*, tables, seen from above; *b*, side view of a table; *c*, developmental stages of tables; *d*, calcareous network, forming an anal tooth.

Fig. 3. *Trochostoma* sp. ? Different kinds of table-like plates.

Fig. 4. *Caudina arenata*, Herrm. *a*, wheel- or cup-shaped deposit seen from the under surface; *b*, the same, seen from above; *c*, deposits from the anal papillæ.

Fig. 5. *Cucumaria hispana*, Verrill. *a*, calcareous ring; *b*, calcareous plates from the body-wall itself; *c*, terminal plate from the podicle; *d*, supporting rods.

Fig. 6. *Cucumaria scotica* var. *calcarulata*, nov. (Station 131.) Several developmental stages of plates.



Reid & Cowie, Lith^rs Edin^r

1, ANKYRODERMA MARENZELLERI, n. sp. 2. TROCHOSTOMA ALBICANS, n. sp. 3. TROCHOSTOMA, sp. (?)
4. CAUDINA CORIACEA, Hutton 5. CUCUMARIA LÆVIGATA, Verrill 6. CUCUMARIA SERRATA, var. INTERMEDIA, n.

PLATE IV.

PLATE IV.

Fig. 1. *Cucumaria serrata*, n. sp. *a*, plates from the body-wall itself; *b*, plates from the tentacles.

Fig. 2. *Cucumaria serrata*, var. *intermedia*, nov. (Station 150). *a*, plates from the body-wall itself; *b*, plates from the pedicels.

Fig. 3. *Cucumaria serrata*, var. *marionensis*, nov. Plates.

Fig. 4. *Cucumaria multipes*, n. sp. Different views of tables.

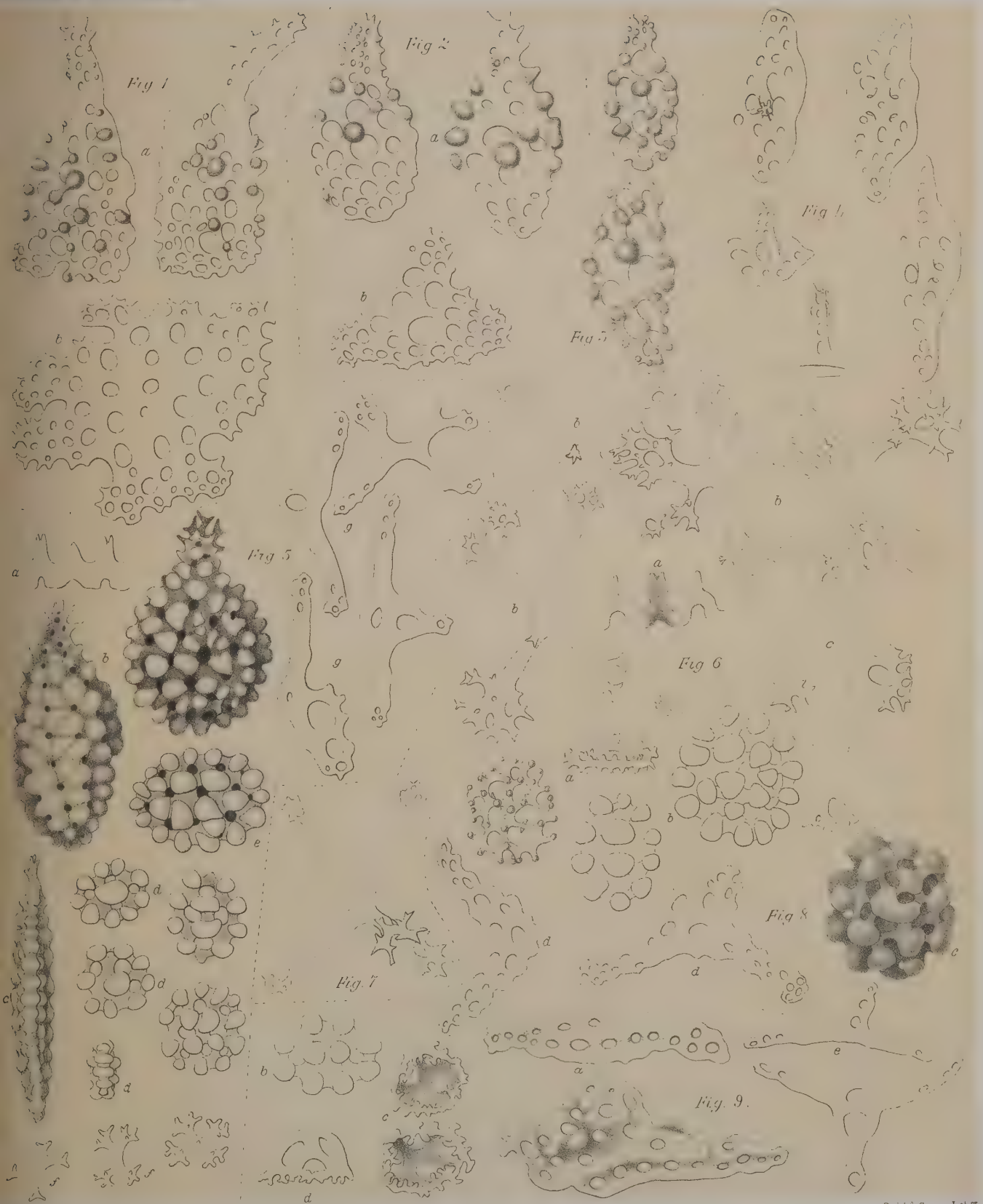
Fig. 5. *Cucumaria insolens*, n. sp. *a*, calcareous ring; *b*, large, elongate, knobbed plates or buttons, with one end prolonged and spinous; *c*, side view of the same plates; *d*, rounded buttons; *e*, transitional form between these two kinds of deposits; *f*, small cruciform bodies; *g*, supporting rods of the pedicels.

Fig. 6. *Cucumaria abyssorum*, n. sp. *a*, calcareous ring; *b*, different kinds of four-armed spicules from the body-wall itself; *c*, spicules from the pedicels.

Fig. 7. *Cucumaria abyssorum*, var. *hyalina*, nov. A four-armed spicule from the body-wall.

Fig. 8. *Cucumaria discolor*, n. sp. *a*, plates or cups from the exterior layer of the perisome; *b*, different kinds of knobbed buttons; *c*. scales; *d*, supporting plates from the ambulacral appendages.

Fig. 9. *Colochirus pygmæus*, n. sp. *a*, perforated plates from the body-wall itself; *b*, buttons; *c*, cups from the exterior layer of the perisome; *d*, side view of a cup, with the spinous, outwardly-directed rim turned downwards; *e*, supporting rods from the ambulacral appendages.



Reid & Cowie. Lith^rs

H.Theel. del.

1, CUCUMARIA SERRATA, n.sp. 2, CUCUMARIA SERRATA, var. INTERMEDIA, n. 3, CUCUMARIA SERRATA, var. MARIONENSIS, n. 4, CUCUMARIA MULTIPES, n.sp. 5, CUCUMARIA INSOLENS, n sp. 6, CUCUMARIA ABYSSORUM, n.sp. 7, CUCUMARIA ABYSSORUM, var. HYALINA, n. 8, CUCUMARIA DISCOLOR, n.sp. 9, COLOCHIRUS PYGMÆUS, n. sp.

PLATE V.

PLATE V.

Fig. 1. *Cucumaria abyssorum*, var. *grandis*, nov. Different kinds of deposits from the body-wall itself.

Fig. 2. *Cucumaria capensis*, n. sp. *a*, cups; *b*, knobbed buttons; *c*, scale-like, knobbed plates; *d*, supporting rods; *e*, calcareous ring.

Fig. 3. *Cucumaria mendax*, n. sp. *a*, plates; *b*, buttons; *c*, supporting rods or plates from the pedicels.

Fig. 4. *Colochirus violaceus*, n. sp. *a*, calcareous ring, six times the natural size; *b*, diverse forms of plates from the body-wall itself; *c*, supporting rods from the ambulacral appendages.

Fig. 5. *Thyonidium rugosum*, n. sp. *a*, calcareous ring, thrice the natural size; *b*, diverse forms of tables from the body-wall itself; *c*, side view of a table; *d*, supporting rods from the pedicels.

Fig. 6. *Orcula hypsipyrgus*, von Marenzeller. *a*, calcareous ring; *b*, diverse forms of tables.

Fig. 7. *Thyone recurvata*, n. sp. *a*, view of plates in natural position; *b*, cups.

Fig. 8. *Phyllophorus incompertus*, n. sp. *a*, calcareous ring; *b*, diverse forms of tables; *c*, deposits from the interior layer of the perisome.

Fig. 9. *Thyone pervicax*, n. sp. *a*, calcareous ring; *b*, cups; *c*, buttons; *d*, supporting rods from the pedicels.

H. Théel del. F. Huth, Lith^r Edin^r

1, CUCUMARIA ABYSSORUM, var. GRANDIS, n. 2, CUCUMARIA CAPENSIS, n. sp. 3, CUCUMARIA MENDAX, n. sp.
4, COLOCHIRUS VIOLACEUS, n. sp. 5, THYONIDIUM RUGOSUM, n. sp. 6, ORCULA HYPSIPYRGUS, von Marenzeller.
7, THYONE RECURVATA, n. sp. 8, PHYLLOPHORUS INCOMPERTUS, n. sp. 9, THYONE PERVICAX, n. sp.

PLATE VI.

PLATE VI.

Fig. 1. *Psolus antarcticus*, Philippi. Deposits from the sole.

Fig. 2. *Psolus squamatus*, Düben and Koren, var. Deposits from the sole.

Fig. 3. *Psolus ephippifer*, Wyv. Thomson. *a*, transverse section of the saddle-like elevation of the dorsal perisome, showing the cloister-like space between the columns; *b*, deposits from the sole; *c*, calcareous ring.

Fig. 4. *Psolus murrayi*, n. sp. *a*, plates from the sole; *b*, cups from the sole.

Fig. 5. *Psolus incertus*, n. sp. *a*, a scale with pores, *x*; *b*, deposits from the sole.

Fig. 6. *Colochirus australis*, Ludwig. *a*, buttons; *b*, a cup; *c*, supporting rods from the pedicels; *d*, piece of the skin with two pedicels.

Fig. 7. *Colochirus quadrangularis*, Lesson. *a*, a spherical, reticulate body; *b*, diverse views of cups; *c*, supporting rod from the pedicels; *d*, flat cups from the pedicels.

Fig. 8. *Colochirus inornatus*, von Marenzeller. *a*, diverse forms of cups from the exterior layer of the perisome; *b*, button.

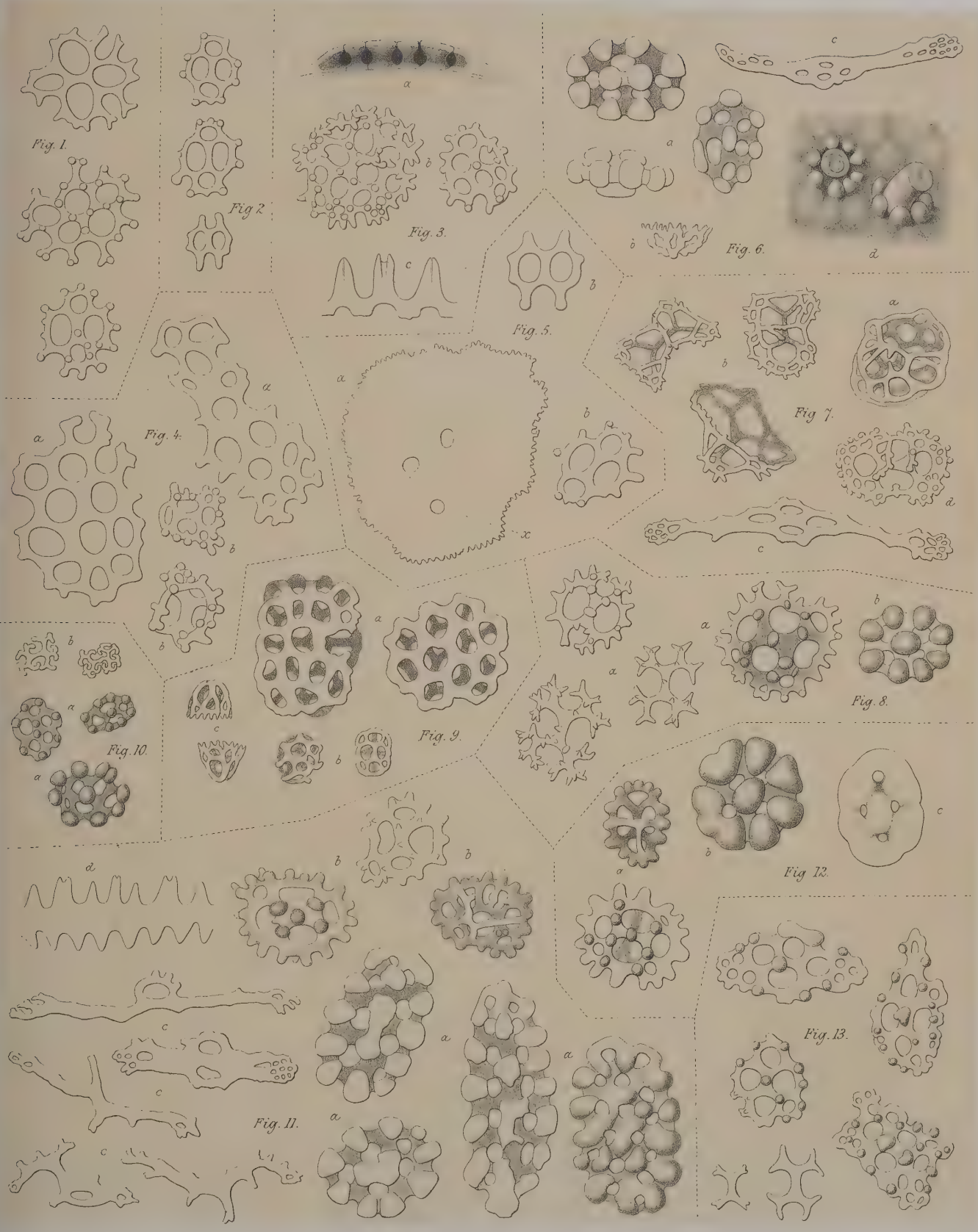
Fig. 9. *Colochirus cucumis*, Semper. *a*, large reticulate spheres; *b*, small reticulate spheres; *c*, cups or hemispheres.

Fig. 10. *Ocnus typicus*, n. sp. *a*, knobbed buttons; *b*, dichotomously branched bodies or rosettes.

Fig. 11. *Colochirus challengeri*, n. sp. *a*, diverse forms of buttons; *b*, upper and under views of cups; *c*, supporting rods of the dorsal pedicels; *d*, calcareous ring, twice the natural size.

Fig. 12. *Colochirus spinosus*, Quoy and Gaimard. *a*, cups; *b* and *c*, buttons.

Fig. 13. *Cucumaria lævigata*, Verrill (from Betsy Cove). Plates from the body-wall itself.



H Théel del.

F Huth, Lith^r Edin^r

1, PSOLUS ANTARCTICUS, Philippi. 2, PSOLUS SQUAMATUS, Düben & Koren, var. 3, PSOLUS EPHIPPIFER, W. Thompson.
4, PSOLUS MURRAYI, n.sp. 5, PSOLUS INCERTUS, n.sp. 6, COLOCHIRUS AUSTRALIS, Ludwig 7, COLOCHIRUS QUADRANGULARIS, Lesson.
8, COLOCHIRUS INORNATUS, von Marenzeller. 9, COLOCHIRUS CUCUMIS, Semper. 10, OCNUS TYPICUS, n.sp.
11, COLOCHIRUS CHALLENGERI, n.sp. 12, COLOCHIRUS SPINOSUS, Quoy & Gaimard. 13, CUCUMARIA LÆVIGATA, Verrill.

PLATE VII.

PLATE VII.

Fig. 1. *Thyone fusus*, var. *papuensis*, nov. *a*, calcareous ring, five times the natural size; *b*, tables from the body-wall itself; *c*, supporting rods from the pedicels.

Fig. 2. *Holothuria fusco-rubra*, n. sp. *a*, tables devoid of spire; *b*, buttons; *c*, plates from the pedicels; *d*, calcareous ring, twice the natural size.

Fig. 3. *Stichopus japonicus*, Selenka. *a* and *b*, tables; *c*, disks of tables and buttons; *d*, supporting rods of the pedicels; *e*, supporting rods of the papillæ.

Fig. 4. *Holothuria atra*, Jæger. *a* and *b*, different views of tables; *c*, plates and rosettes.

Fig. 5. *Stichopus haytiensis*, Semper (?). *a*, disks of the tables, seen from the under surface; *b*, ends of the spire of the tables; *c*, side view of a table; *d*, incomplete table from the pedicels; *e*, calcareous ring, twice the natural size; *f*, a C-shaped body.

Fig. 6. *Stichopus chloronotus*, Brandt. *a*, disks of the tables, seen from the under surface; *b*, ends of the spire of the tables, seen from above; *c*, side view of a table; *d*, a rosette-shaped or dichotomously branched body; *e*, C-shaped bodies; *f*, calcareous ring, about three times the natural size; *g*, rods from the pedicels.

Fig. 7. *Stichopus variegatus*, Semper. *a*, disks of the tables, seen from the under surface; *b*, end of the spire of a table, seen from above; *c*, side view of a table; *d*, rosette-shaped or dichotomously branched bodies; *e*, C-shaped bodies; *f*, rods from the pedicels.

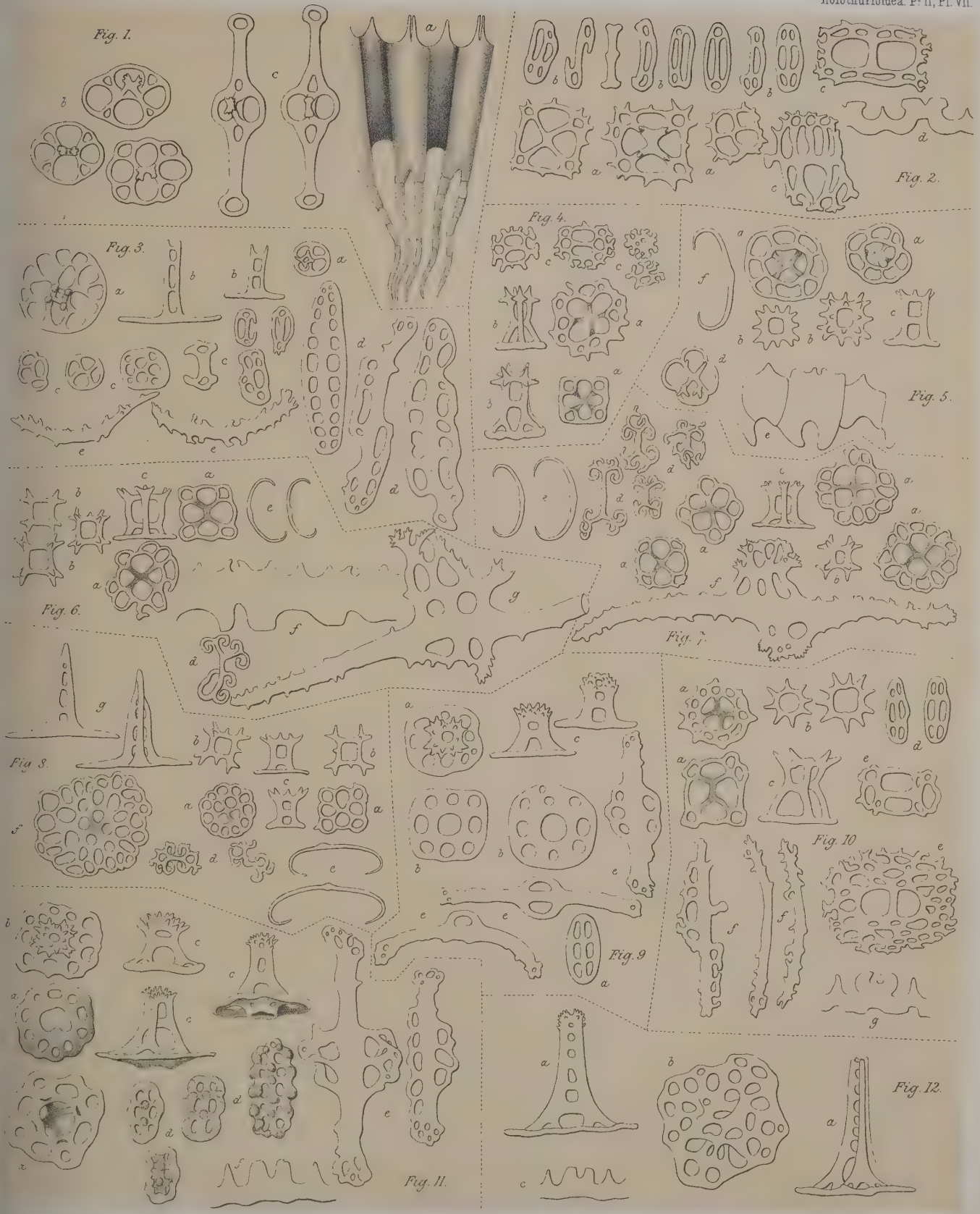
Fig. 8. *Stichopus godeffroyi*, var. *b*, Semper. *a*, disks of the tables; *b*, ends of the spire, seen from above; *c*, side views of tables; *d*, rosettes; *e*, C-shaped bodies; *f*, disk of a large table with the spire conical, terminating in a single top; *g*, side views of large tables with conical spire.

Fig. 9. *Holothuria impatiens*, Forskaal. *a*, a table seen from above; *b*, disks of tables seen from the under surface; *c*, side views of tables; *d*, button; *e*, supporting rods from the ambulacral appendages.

Fig. 10. *Holothuria vagabunda*, Selenka. *a*, disks of tables; *b*, ends of the spires of the tables; *c*, side view of a table; *d*, buttons; *e*, supporting plates from the ventral pedicels; *f*, supporting rods from the papillæ; *g*, calcareous ring.

Fig. 11. *Holothuria ocellata*, Jæger. *a*, disks of the tables, seen from the under surface; *b*, table seen from above; *c*, side views of tables; *d*, buttons; *e*, supporting rods from the papillæ; *f*, calcareous ring, about twice the natural size.

Fig. 12. *Holothuria martensii*, Semper. *a*, side views of tables; *b*, disk of the tables, seen from the under surface; *c*, calcareous ring, twice the natural size.



H. Theel, del.

F. Huth, Lith^r Edin^r

1, THYONE FUSUS, var. PAPUENSIS, n. 2, HOLOTHURIA FUSCO-RUBRA, n. sp. 3, STICHOPUS JAPONICUS, Selenka.
4, HOLOTHURIA ATRA, Jæger. 5, STICHOPUS HAYTIENSIS, Semper(?) 6, STICHOPUS CHLORONOTUS, Brandt.
7, STICHOPUS VARIEGATUS, Semper. 8, STICHOPUS GODEFFROYI, var b Semper. 9, HOLOTHURIA IMPATIENS, Forskaal
10, HOLOTHURIA VAGABUNDA, Selenka. 11, HOLOTHURIA OCELLATA, Jæger. 12, HOLOTHURIA MARTENSII, Semper.

PLATE VIII.

PLATE VIII.

Fig. 1. *Holothuria spinifera*, n. sp. *a*, side view of a table ; *b*, disk of a table, seen from the under surface ; *c*, side view of a large table, belonging to the papillæ ; *d*, disk of the same table, seen from the under surface; *e*, buttons, seen from above ; *f*, side views of buttons ; *g*, supporting rods from the ambulacral appendages.

Fig. 2. *Stichopus japonicus*, var. *typicus*, nov. *a*, disk of a table, seen from the under surface ; *b* and *c*, side views of tables ; *d*, diverse forms of tables with the spire more or less reduced ; *e*, supporting rods from the dorsal processes ; *f*, dorsal view of the calcareous ring ; *g*, ventral view of the calcareous ring.

Fig. 3. *Stichopus sordidus*, n. sp. *a*, spire of a table, seen from above ; *b*, side view of a table ; *c*, disks of the tables, seen from the under surface ; *d*, fenestrated plate from the pedicels.

Fig. 4. *Psolus incertus*, n. sp. Side view, twice the natural size.

Fig. 5. *Phyllophorus incompertus*, n. sp. Anterior extremity of the body.

Fig. 6. *Thyone recurvata*, n. sp. Side view, natural size.

Fig. 7. *Holothuria africana*, n. sp. *a*, spire of the tables, seen from above ; *b*, side view of a table ; *c*, disks of the tables, seen from the under surface ; *d*, irregularly rectangular plates ; *e*, rounded plates.

Fig. 8. *Holothuria minax*, n. sp. *a*, upper view of a table ; *b*, disks of the tables, seen from the under surface ; *c*, buttons ; *d*, supporting rods from the pedicels.

Fig. 9. *Holothuria curiosa*, Ludwig. *a*, diverse forms of tables ; *b*, buttons ; *c*, elongate buttons from the pedicels ; *d*, supporting rods or plates from the pedicels.

Fig. 10. *Holothuria monacaria*, Lesson. *a*, upper view of a table ; *b*, under views of tables ; *c*, side view of a table ; *d*, buttons ; *e*, supporting rods from the pedicels ; *f* and *g*, rods from the dorsal appendages.

H. Theel del. F. Huth, Lith^r Edin^r

1, HOLOTHURIA SPINIFERA, n.sp. 2, STICHOPUS JAPONICUS var. TYPICUS, n. 3, STICHOPUS SORDIDUS, n.sp.
4, PSOLUS INCERTUS, n.sp. 5, PHYLLOPHORUS INCOMPERTUS, n.sp. 6, THYONE RECURVATA, n.sp. 7, HOLOTHURIA AFRICANA, n.sp
8, HOLOTHURIA MINAX, n.sp. 9, HOLOTHURIA CURIOSA, Ludwig. 10, HOLOTHURIA MONACARIA, Lesson.

PLATE IX.

PLATE IX.

Fig. 1. *Stichopus möbii*, Semper. *a* and *b*, under view and side view of the common tables; *c*, end of the spire of the same tables, seen from above; *d*, side views of larger tables; *e*, under views of larger tables; *f*, supporting rods from the pedicels; *g*, C-shaped body.

Fig. 2. *Holothuria murrayi*, var. *parva*, nov. *a*, disk of the common form of tables, seen from the under surface; *b*, disk of the rare tables, seen from the under surface; *c*, side view of a table; *d*, end of the spire of the tables.

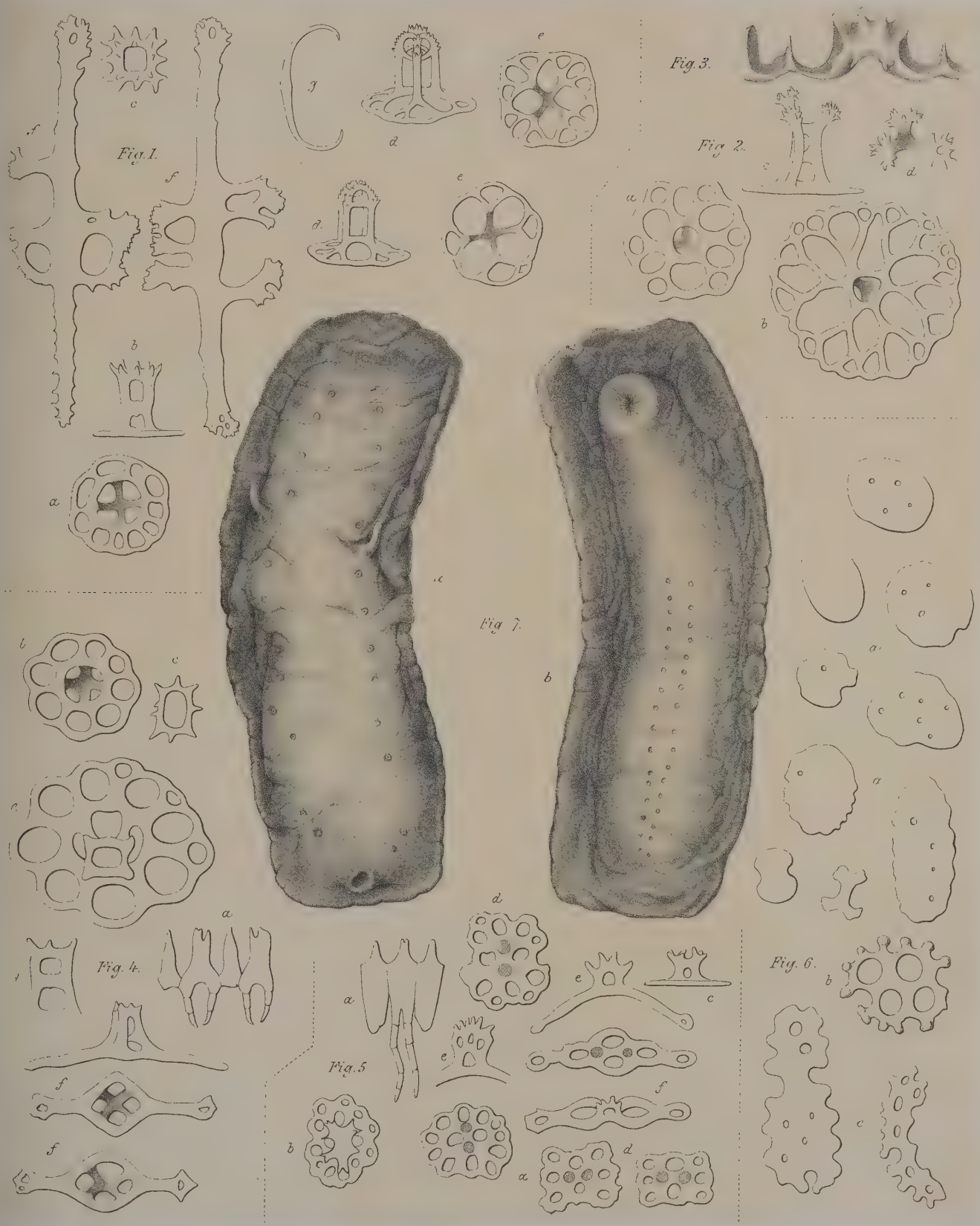
Fig. 3. *Holothuria murrayi*, n. sp. (var.?). Calcareous ring, three times the natural size.

Fig. 4. *Thyonidium cebuense*, Semper. *a*, calcareous ring, about seven times the natural size; *b*, *c*, *d*, diverse views of small tables; *e*, a large table seen from above; *f*, rod-like tables from the pedicels.

Fig. 5. *Cucumaria mirabilis*, n. sp. *a*, calcareous ring, about twenty times the natural size; *b*, *c*, *d*, diverse views of tables; *e*, *f*, diverse views of supporting rods from the ambulacral appendages.

Fig. 6. *Psolus disciformis*, n. sp. *a*, *b*, plates from the sole; *c*, rods from the pedicels.

Fig. 7. *Pælopatides confundens*, n. sp. *a*, dorsal view; *b*, ventral view, natural size.



H. Théel del. P. Huth, Lith^r Edin^r

1, STICHOPUS MOEBII, Semper. 2, HOLOTHURIA MURRAYI var. PARVA, n. 3, HOLOTHURIA MURRAYI, n. sp. (var?)
4, THYONIDIUM CEBUENSE, Semper. 5, CUCUMARIA MIRABILIS, n. sp. 6, PSOLUS DISCIFORMIS, n. sp.
7, PÆLOPATIDES CONFUNDENS, n. sp.

PLATE X.

PLATE X.

Fig. 1. *Pælopatides confundens*, n. sp. (Station 299). Spicules from the dorsal papillæ.

Fig. 2. *Stichopus torvus*, n. sp. Calcareous ring, thrice the natural size.

Fig. 3. *Stichopus torvus*, n. sp. Branched processes from the sides of the body.

Fig. 4. *Stichopus torvus*, n. sp. A portion of the genital bundles, natural size.

Fig. 5. *Pseudostichopus mollis*, n. sp. Posterior extremity of the body, natural size. *a*, anal furrow.

Fig. 6. *Pseudostichopus mollis*, n. sp. Calcareous ring, four times the natural size.

Fig. 6*b*. *Pseudostichopus villosus*, var. *violaceus*, nov. Calcareous ring, almost natural size.

Fig. 7. *Pælopatides confundens*, n. sp. (Station 300). Three-armed spicule.

Fig. 8. *Holothuria thomsoni*, n. sp. (Station 244). Tables, seen from above.

Fig. 9. *Holothuria lactea*, n. sp. (Station 78). Table, seen from above.

Fig. 10. Holothurid, from Station 271. Four-armed spicule with a central spinous column.

Fig. 11. *Holothuria thomsoni*, n. sp. (Station 237). *a*, upper view of a table; *b*, side view of a table; *c*, a spicule from the pedicels; *d*, *e*, tables from the pedicels, seen from the under surface.

Fig. 12. Holothurid, from Station 89. Two forms of spicules.

Fig. 13. *Pælopatides aspera*, n. sp. Upper view of a spinous four-armed spicule.

Fig. 14. Holothurid, from Station 298. Calcareous ring, twice the natural size.

Fig. 15*a*. *Holothuria lactea*, n. sp. Calcareous ring.

Fig. 15*b*. *Holothuria lactea*, n. sp. (Station 169). Side view of a table.

Fig. 16. *Holothuria murrayi*, n. sp. Calcareous ring, twice the natural size.

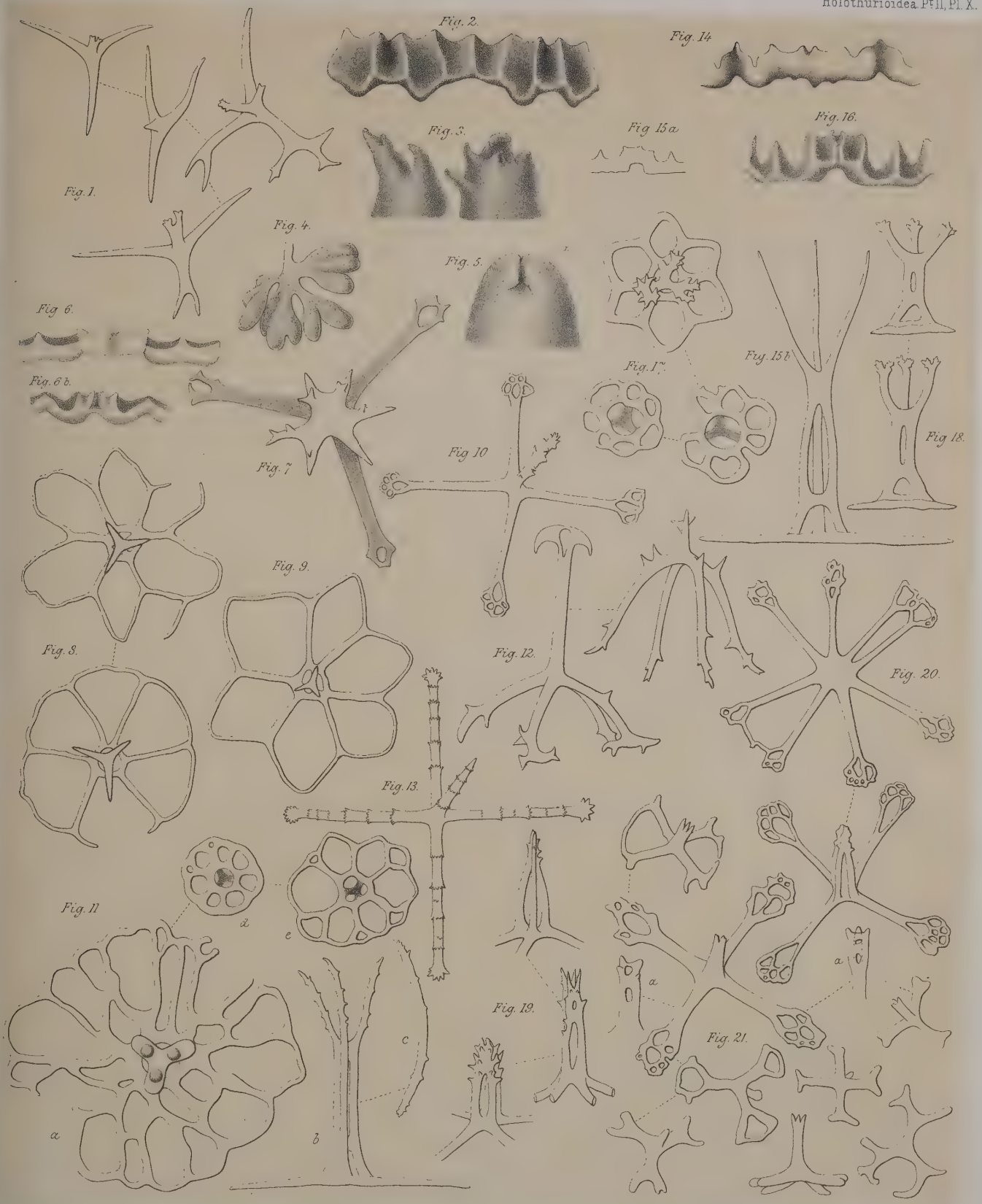
Fig. 17. *Holothuria murrayi*, n. sp. Upper and under views of tables.

Fig. 18. *Holothuria murrayi*, n. sp. Side views of tables.

Fig. 19. *Stichopus moseleyi*, n. sp. Side views of the spire of the tables.

Fig. 20. *Stichopus moseleyi*, n. sp. Upper and under views of tables.

Fig. 21. *Stichopus challengeri*, n. sp. Diverse views of tables. *a*, ends of the spires.



H. Théel. del.

F. Huth, Lithʳ Edinʳ

1, PÆLOPATIDES CONFUNDENS n.sp. 2-4, STICHOPUS TORVUS, n.sp. 5-6, PSEUDOSTICHOPUS MOLLIS, n.sp. 6b, PSEUDOSTICHOPUS VILLOSUS, var. VIOLACEUS, n. 7, PÆLOPATIDES CONFUNDENS, n.sp. 8, HOLOTHURIA THOMSONI, n.sp. 9, HOLOTHURIA LACTEA, n.sp. 10, HOLOTHURID from St. 271. 11, HOLOTHURIA THOMSONI, n.sp. 12, HOLOTHURID from St. 89. 13, PÆLOPATIDES ASPERA, n.sp. 14, HOLOTHURID from St. 298. 15, HOLOTHURIA LACTEA, n.sp. 16-18, HOLOTHURIA MURRAYI, n.sp. 19-20, STICHOPUS MOSELEYI, n.sp. 21, STICHOPUS CHALLENGERI, n.sp.

PLATE XI.

PLATE XI.

Fig. 1. *Trochostoma violaceum*, Studer. View of the internal organisation from the anterior portion of the body. *a*, calcareous ring; *b*, tentacular ampullæ; *c*, water-vascular ring; *d*, Polian vesicle; *e*, madreporic canal; *f*, intestine; *g*, vessels; *x*, genital organs.

Fig. 2. *Ankyroderma simile*, n. sp. Seen from the anterior extremity of the body.

Fig. 3. *Trochostoma albicans*, n. sp. Anterior portion of the body with mouth and tentacles; *g*, genital papilla.

Fig. 1.

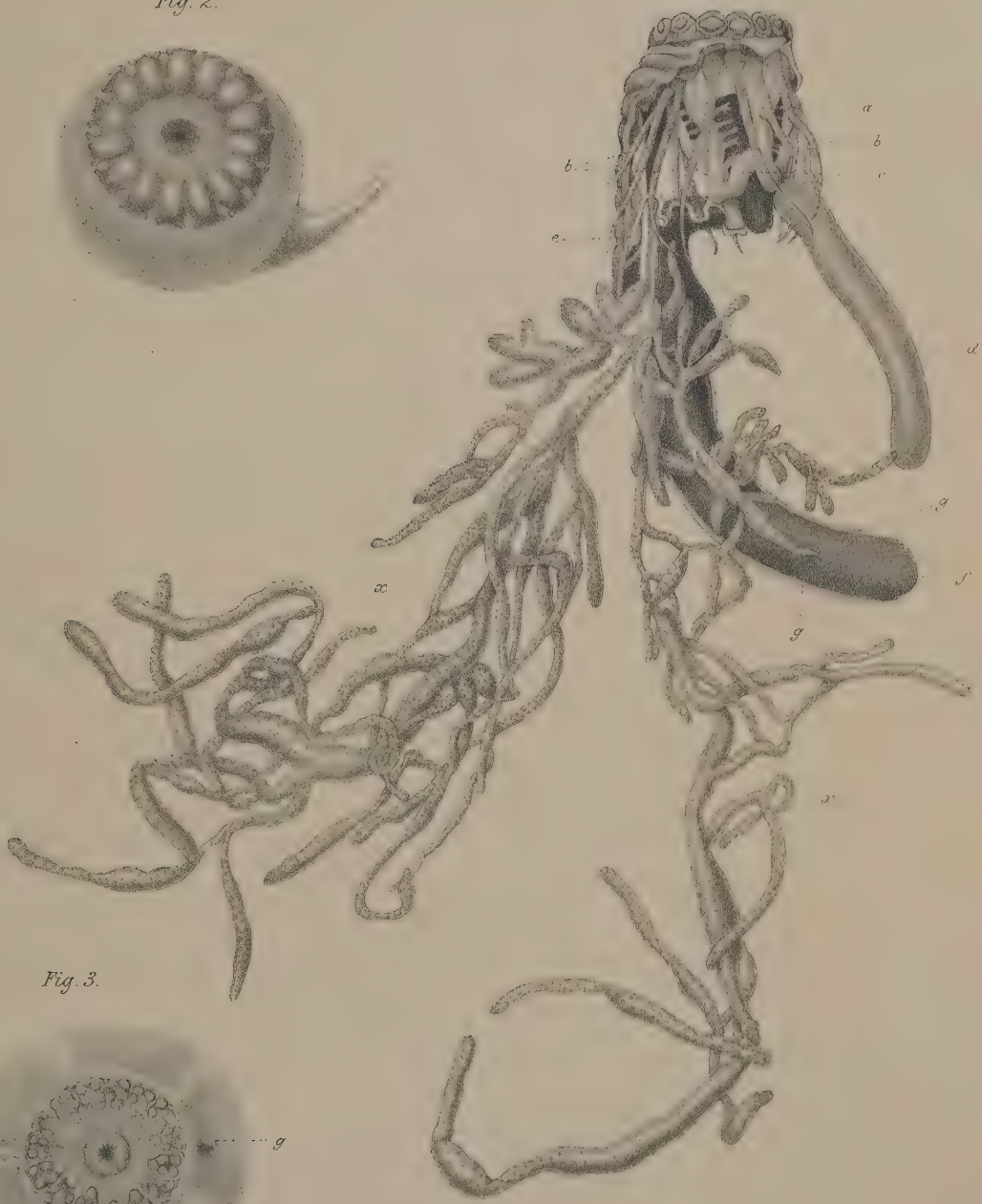
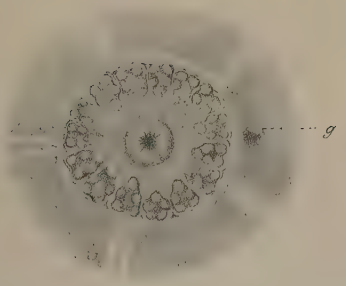


Fig. 2.

Fig. 3.



G. Kolthoff del.

F. Huth, Lith^r Edin^r

1, TROCHOSTOMA VIOLACEA, Studer. 2, ANKYRODERMA SIMILE, n. sp. 3, TROCHOSTOMA ALBICANS, n. sp.

PLATE XII.

PLATE XII.

Fig. 1. *Cucumaria crocea*, Lesson. Ventral view, natural size

Fig. 2. *Cucumaria crocea*, Lesson. Dorsal view, natural size.

Fig. 3. *Thyone pervicax*, n. sp. Dorsal view, six times the natural size.

Fig. 4. *Actinòcucumis typica*, Ludwig. Ventral view, natural size.

Fig. 5. *Actinocucumis typica*, Ludwig. Dorsal view, natural size.

Fig. 6. *Cucumaria kerguelensis*, n. sp. Ventral view, natural size.

Fig. 7. *Cucumaria kerguelensis*, n. sp. Dorsal view, natural size.

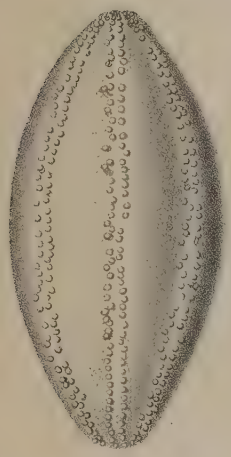


Fig. 1

Fig. 2

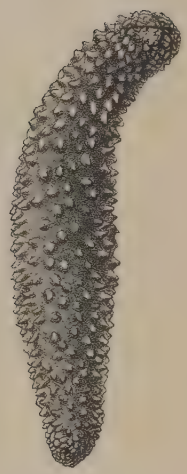


Fig. 3

Fig. 4

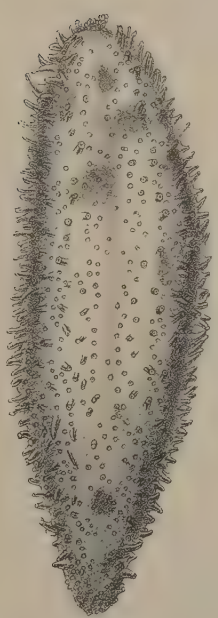


Fig. 5

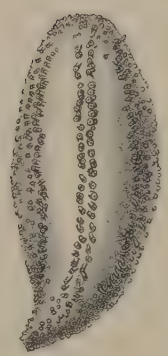


Fig 6

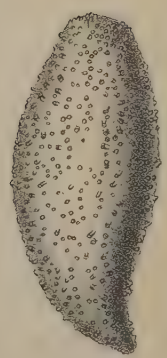


Fig. 7

C.Kolthoff, del.

Reid & Cowie Lith.rs

1-2 CUCUMARIA CROCEA, Lesson. 3, THYONE PERVICAX, n.sp. 4-5, ACTINOCUCUMIS TYPICA, Ludwig.
6-7, CUCUMARIA KERGUELENSIS, n.sp.

PLATE XIII.

PLATE XIII.

Fig. 1. *Colochirus violaceus*, n. sp. Ventral view, natural size.

Fig. 2. *Colochirus violaceus*, n. sp. Dorsal view, natural size. The skin is cut up so that some of the internal organs become visible. *m*, mouth; *a*, anus; *t*, anal teeth.

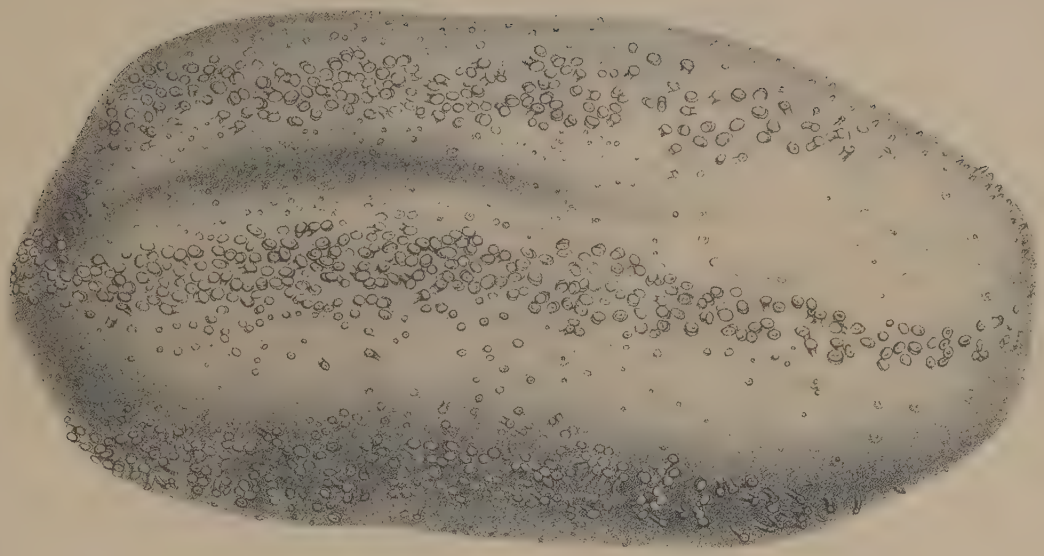


Fig. 1.

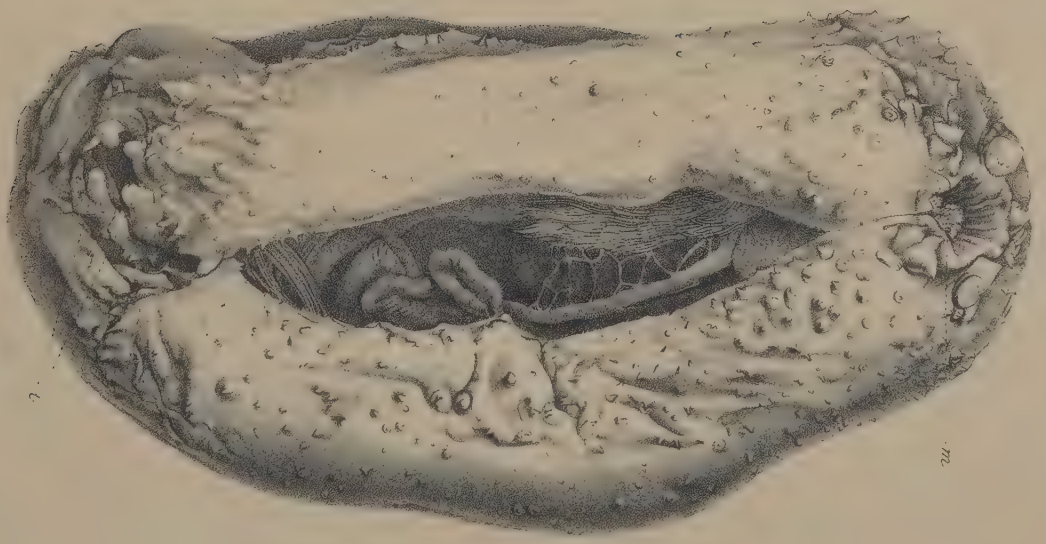


Fig. 2.

C. Kolthoff del.

F Huth, Lith^r Edin^r

COLOCHIRUS VIOLACEUS, n sp

PLATE XIV.

PLATE XIV.

Fig. 1. *Colochirus challengeri*, n. sp. Dorsal view, natural size. *a*, anus.

Fig. 2. *Colochirus challengeri*, n. sp. Ventral view, natural size.

Fig. 3. *Colochirus spinosus*, Quoy and Gaimard. Dorsal view, natural size. *a*, anus.

Fig. 4. *Colochirus spinosus*, Quoy and Gaimard. Side view, natural size.

Fig. 5. *Colochirus australis*, Ludwig. Dorsal view, natural size.

Fig. 6. *Colochirus australis*, Ludwig. Ventral view, natural size.

Fig. 7. *Colochirus quadrangularis*, Lesson. Dorsal view, natural size. *a*, anus.

Fig. 8. *Colochirus quadrangularis*, Lesson. Ventral view, natural size.

Fig. 9. *Colochirus cucumis*, Semper. Dorsal view, natural size. *a*, anus.

Fig. 10. *Colochirus cucumis*, Semper. Ventral view, natural size.

Fig. 11. *Ocnus typicus*, n. sp. Side view, about twice the natural size.

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

Fig. 7.

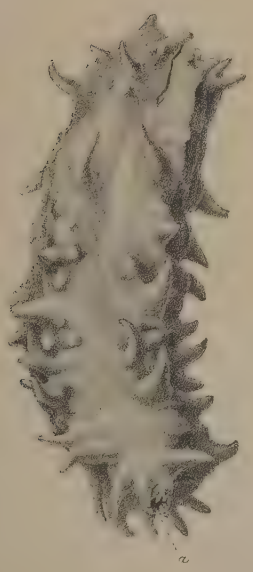


Fig. 8.

Fig. 9.

Fig. 10.

Fig. 11.

G. Kolthoff del.

F. Huth, Lith^r Edin^r

1-2, COLOCHIRUS CHALLENGERI, n. sp. 3-4, COLOCHIRUS SPINOSUS, Quoy & Gaimard. 5-6, COLOCHIRUS AUSTRALIS, Ludwig. 7-8, COLOCHIRUS QUADRANGULARIS, Lesson. 9-10, COLOCHIRUS CUCUMIS, Semper. 11, OCNUS TYPICUS, n. sp.

PLATE XV.

PLATE XV.

Fig. 1. *Psolus squamatus*, Düben and Koren (var.?) (Station 307). Dorsal view, natural size. *m*, mouth; *a*, anus.

Fig. 2. *Psolus squamatus*, Düben and Koren (var.?) (Station 307). Ventral view, natural size.

Fig. 3. *Psolus antarcticus*, Philippi (Station 308). Dorsal view, natural size. *m*, mouth; *a*, anus.

Fig. 4. *Psolus antarcticus*, Philippi (Station 308). Ventral view, natural size.

Fig. 5. *Psolus murrayi*, n. sp. Dorsal view, three times the natural size. *m*, mouth; *a*, anus.

Fig. 6. *Psolus murrayi*, n. sp. Ventral view, three times the natural size.

Fig. 7. *Psolus ephippifer*, Wyv. Thomson. Dorsal view of a male, slightly magnified. *a*, anus; *v*, oral valves.

Fig. 8. *Psolus ephippifer*, Wyv. Thomson. Ventral view of a male.

Fig. 9. *Psolus ephippifer*, Wyv. Thomson. Dorsal view of a young immature female, natural size.

Fig. 10. *Psolus ephippifer*, Wyv. Thomson. Dorsal view of a mature female, slightly magnified. *v*, oral valves.

Fig. 11. *Psolus ephippifer*, Wyv. Thomson. Dorsal view of a mature female, slightly magnified, most of the exterior disks of the card-table shaped scales having been removed.

Fig 1

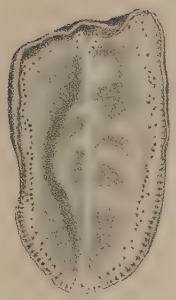


Fig 2

Fig 3

Fig 4

Fig 5.

Fig 6

Fig 7

Fig 8

Fig. 9

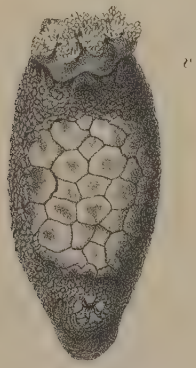


Fig. 10.

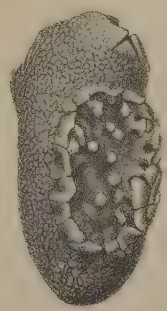


Fig. 11.

G Kolthoff, del.

Reid & Cowie, Lith^rs Edin^r

1-2. PSOLUS SQUAMATUS, Düben & Koren. (var ?). 3-4, PSOLUS ANTARCTICUS, Philippi. 5-6, PSOLUS MURRAYI, n sp.
7-11, PSOLUS EPHIPPIFER, Wyville Thomson.

PLATE XVI.

PLATE XVI.

Fig. 1. *Holothuria ocellata*, Jæger. Dorsal view, natural size.

Fig. 2. *Holothuria martensii*, Semper. Dorsal view, natural size.

Fig. 3. *Cucumaria mendax*, n. sp. (Station 315). Natural size.

Fig. 4. *Holothuria murrayi*, var. *parva* nov. (Station 219). Ventral view, natural size.

Fig. 5. *Holothuria murrayi*, var. *parva* nov. (Station 219). Dorsal view, natural size.

Fig. 6. *Cucumaria abyssorum*, n. sp. (Station 156). Natural size.

Fig. 1

Fig. 2.

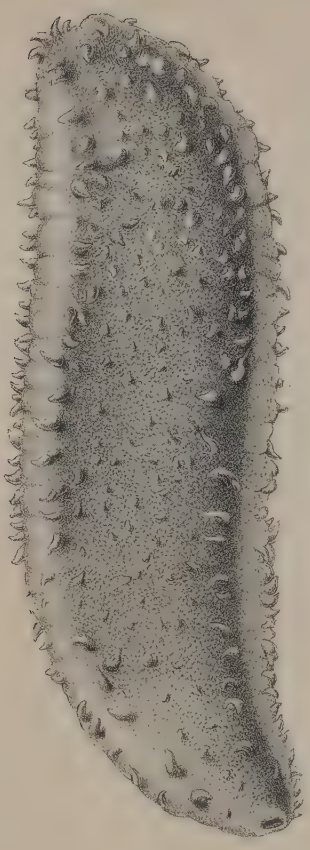
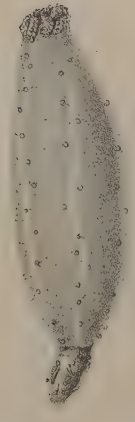


Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.



Romin & Théel del.

F Huth, Lith^r Edin^r

1, HOLOTHURIA OCELLATA, Jæger. 2, HOLOTHURIA MARTENSII, Semper. 3, CUCUMARIA MENDAX n. sp.
4-5 HOLOTHURIA MURRAYI var. PARVA, n. 6, CUCUMARIA ABYSSORUM n. sp.

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